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SCIENTIFIC PAPERS AND ADDRESSES

ROLLESTON

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GEORGE ROLLESTON, M.D.

SCIENTIFIC PAPERS

AND

ADDRESSES

BY

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WITH PORTRAIT, PLATES, AND WOODCUTS

VOL. I

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PREFACE.

THESE volumes contain a selection of the most important Essays contributed by the late Professor Rolleston to the Transactions of various learned Societies and to scientific Journals. Along with them are also reprinted several Addresses delivered before the British Association for the Advancement of Science and other learned bodies.

These reprints have been arranged in the following sections: I. Anatomy and Physiology, in which are included many important Anthropological memoirs; II. Zoology, including his Memoirs on Archæo-zoology; III. Archæology; IV. Addresses and Miscellaneous papers.

Amongst the unpublished manuscripts left by Dr. Rolleston were notes on various subjects of archæological interest, which, owing to the failure in health that for some months preceded his much lamented death, he had evidently been unable to prepare for publication. Of these, his notes on the site of some Roman pottery works discovered in 1879 at the Mynchery upon the Sewage Farm near Littlemore, Oxford; also notes on archæological discoveries made both at Wytham, Berks, and at Yarnton, Oxfordshire, are of much interest. Unfortunately these notes are too fragmentary to be reproduced in the form in which he left them, but I have prepared a digest, which has been printed as an appendix to the second volume.

I have to thank the Councils of the Anthropological Institute, the Zoological Society, the Linnean Society, the Society of Antiquaries, the Royal Geographical Society, the Delegates of

the Clarendon Press, Messrs. Macmillan & Co., and C. G. Oates, Esq., for permission to reprint the Papers published under their respective auspices,—and the Messrs. Churchill for the use of a number of woodcuts.

I have also to express my great indebtedness to Mrs. Rolleston for much valuable assistance in collecting the Papers; to Dr. James Murie, and Charles Robertson, Esq., for important help in compiling the chronological list of published writings; and to the latter gentleman, and W. Hatchett Jackson, Esq., for the aid they have given me in identifying some of the objects referred to in certain of the Papers with specimens contained in the Oxford Museum, and for other information. I have also received hints and suggestions of various kinds from Sir George Burrows, Bart., Sir Henry W. Acland, K.C.B., Prof. Flower, Prof. Max Müller, Prof. Moseley, J. Park Harrison, Esq., Edward Chapman, Esq., Dr. A. B. Shepherd, F. E. Beddard, Esq., E. S. Cobbold, Esq., and H. D. Rolleston, Esq., to all of whom I wish to convey my thanks.

A Biographical Memoir has, at Mrs. Rolleston's request, been kindly prepared by E. B. Tylor, Esq.

I consider it a privilege to have been entrusted with the work of arranging and editing this collection of the writings of the late Professor Rolleston, whose acquaintance I made when we studied medicine together in the school of St. Bartholomew's Hospital, whose friendship I enjoyed uninterruptedly for a period of thirty years, and for whose talents, learning, and personal character I entertain the highest respect and esteem.

WM. TURNER.

University of Edinburgh,
June, 1884.

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LIFE OF

DR. ROLLESTON.

MATERIALS for a full memoir of Professor Rolleston do not exist. But his letters, and the recollections of friends, have preserved some details of the life of a man whose power of mind and nobility of character made him a figure of moment in Oxford during the years 1860–1880, a period full of importance in the history of the University.

The Rollestons doubtless had their name from one of the old townships in mid or north England, named from some chief bearing the Danish name of Rolf, and which in Domesday are variously written *Rolvetune*, *Rolvestune*, *Rollestune*, *Rollestone*. The family were of good standing in Derbyshire early in the 18th century, and their first appearance in the world of letters was made by Miss Frances Rolleston, born in 1781, a lady well known in Evangelical circles, zealous for the abolition of slavery, and a supporter of the temperance movement in its beginnings. Living at Keswick, she knew Wordsworth and Southey, about whom her published letters contain some stories; but her main claim to popularity consists in a book entitled 'Mazzaroth; or the Constellations,' an abridgment of which was published so late as 1879. In it she discovers primeval prophecies in the signs of the Zodiac, ending with the Fishes, to her an anticipation of the well-known Christian emblem, and a prophetic type of the multitudes of the Church to come. Educated people are now apt to smile at the etymological vagaries which were this learned lady's grounds of argument; thus it seemed quite obvious to her that the Hebrew word *or*, 'light,' was the source of the French word for 'gold.' But it is instructive to remember

that this is not very unlike what the world of those days took quite gravely in the learned quartos of Bryant and Faber. In one of Miss Rolleston's letters (1837) she records that at Maltby she taught Hebrew to one of her nephews, 'the very cleverest boy I ever knew.' This was George Rolleston, then eight years old, but who in after life did not quite reciprocate his aunt's admiration. Indeed, he used to descant with humorous horror on his sufferings when once introduced to a large and serious evening party as the nephew of the great Miss Rolleston, the authoress of 'Mazzaroth.'

The Maltby just mentioned is a village near Rotherham in Yorkshire, where the Rev. George Rolleston combined the functions of squire and vicar, living at Maltby Hall; and his son George was born July 30, 1829. The sisters of the younger George Rolleston, the subject of this memoir, still tell of their wonder at the ways of the odd clever boy, rolling lazily on the hearth-rug, or with his head between his hands buried in a story-book, yet all the time knowing whatever was read or said, and ready with the lessons he seemed scarcely to have looked at. Taught by his father, a fine classical scholar, the lad is said to have been able at ten years old to read Homer at sight. Some of these family stories have an interest as explaining Rolleston's later life. It has been thought extraordinary that a man whose school and college education was entirely classical, should have turned into so thorough an anatomist and zoologist. But in fact this was a reversion to the tastes of boyhood, when at six years old, dressed in his little crimson pelisse, he would go out in the snow alone to attend to his duties as 'keeper,' and set the traps in the plantations round the house. Brought up on Izaak Walton, White's 'Natural History of Selborne,' and Stanley's 'History of Birds,' he knew all the birds and their nests, and could tell them by their flight at great distances. In his schoolboy days he had taken to preparing skins, and setting up skeletons of mice and weasels in his little room, the smell of which the inmates of the house remember after half-a-century. An old servant says of him:

'He was very fond of animals and birds, and dissecting them. I once went in to call him for dinner, and the table was spread all over with birds and a foumart (polecat) he had dissected, and he showed me the different parts of the stomach. The white cat was brought up for me to see; he was waiting to dissect it, he said.' Not less significant of his future was his setting up heaps of stones to record the death of a favourite animal or other event. A boy who at eight years old piled up in the plantation a memorial cairn to commemorate his sister's recovery from scarlatina, was well started on the line for an explorer of ancient burial-mounds. George Rolleston had all the love of shooting and fishing of a Yorkshire moorland lad, but in later life his sensitiveness as to giving pain increased from year to year, till he came to look on field sports with horror. He used often to tell how when a boy he once went out shooting with a man-servant, and seeing something move in the hedge he fired at it, when the supposed rabbit dropped into the ditch, and the serving-man remarked it was 'only a boy.' Rolleston threw down his gun in despair, but the man consoled him with, 'Never mind, Master George, there's plenty more in Maltby.' After all, the boy was unhurt, and it was the sportsman's mind that received the shock.

At ten years old he was sent to the Grammar School at Gainsborough. With pride in this advancement, when his eldest sister, who had taught him writing, now recommended his attending to it, he wrote a reply so characteristic that it has been kept—'I have now no person to call "upstroke" and "downstroke." I have now such a great deal of writing every day and night, and if it is not written well it is not signed, so that there is no need of that friendly advice.' He stayed about two years at Gainsborough, and afterwards went to the Collegiate School at Sheffield, then under Dr. Jacob. His schoolfellows remember him getting candle ends and sitting up to read at forbidden hours, and sending fags to bring him books as he lay in bed in the early summer mornings. At seventeen he competed for an open scholarship at Pembroke College, Oxford, and

was elected. It was in 1847 that he came into residence, and one who came up about the same time describes him as a tall thin lad, looking quite a schoolboy, with his clothes showing recent growth of limbs which had left the tailor behind. Another contemporary, who knew him well, remembers how young he was in every way, beginning at first sight to tell with schoolboy frankness all about his study at Sheffield, how he furnished it, how the boy next him had died, and how he had read all his Greek plays.

The Master of the College did not mind his youth, and only said, 'He is a clever Yorkshireman, and when a Yorkshireman is clever, he *is* clever.' Boy as he was, he took rank at once. It was the time when the College was undergoing transformation. Dr. Jeune, Dean of Jersey (afterwards Bishop of Peterborough), had lately succeeded Dr. Hall as Master. Under him Pembroke was just on the change from a small close foundation, chiefly limited to certain schools and localities and to founders' kin. The buildings were insufficient and some were dilapidated, and the undergraduates few, when the new Master set himself to fill the ranks of the College; funds supplied by benefactors were made effective in open scholarships and fellowships, and rebuilding and reorganisation had gone well forward before the time came when parliamentary powers were obtained to do away with the limitations of the old foundation. Thus Rolleston's connexion with Pembroke began in years of change and activity, and threw him into the midst of a society more mixed even than usual through the overlapping of the old and new *régimes*. Though never hiding his own strong likes and dislikes, he already had the faculty of getting on with men of different kinds, the boating men, the fast men, the quiet reading men, and the *dilettanti*, who would nowadays be called æsthetes. Yet his character was already so fixed, that the influences which might have moved a more moveable disposition left him substantially what home teaching had made him years before. In the common dissipations of undergraduate life he took no part; in fact, he worked too hard. When he lived out of

college, his incessant reading through the night, or in summer in the window-seat in the full glare of sunshine, was a wonder to the people at his lodgings; they once ran up to tell him of a great fire, but he only said, 'How peculiar!' and would no more look up from his work than if he had been Archimedes. To be late for a lecture was a sin he could never forgive himself for. Once he was at a breakfast in college, when ten o'clock struck; he rushed headlong downstairs, struggling into his gown as he went, meeting half-way the upcoming scout, who was knocked to the bottom of the flight, and to this day carries in a broken nose the record of punctuality. When Rolleston came to be himself a lecturer, he was in like manner severe on his class, though in his later years he relaxed a little. He used to say, 'When I was young I could never forgive my men for being late—but now I give 'em five minutes.' It must not be thought, however, that this studious life was due to want of ability for manly exercises. At school the old drill-sergeant would not condescend to fence with any other boy but Rolleston, who, he used to say, was the only one who could handle a single-stick if the Mounseers came among us. He rowed in his College eight, and kept up through life his fondness for the river, priding himself on his pupils who distinguished themselves there—indeed his class sometimes fancied that he tolerated their shortcomings more easily than those of other men.

An influence one would have expected to find marks of in Rolleston's character was the religious controversy which then divided Oxford. Newman and Pusey had raised the standard of church supremacy, and a phalanx of zealous youths followed their lead. Since then Stanley, preaching for liberty, had raised a new spirit among many of the bolder and more independent. Thus within the lines of the Church of England there was renewed the world-old strife between authority and reason, with its usual distracting results of personal animosity and social division. Rolleston's temper and work both kept him outside the actual battle of theology. The ceremonies, the symbolisms, the ecstasies of the High Church School wanted the reality he cared for. The

Broad Church School, more sympathetic to him, relieved him in his scientific work from the pressure of theological restraint, while enlarging his tolerance of other men's views to the widest stretch. But from first to last he held for himself, beneath and almost untouched by theological or scientific discussion, the faith of his early youth, much as he had it from his father, the Yorkshire clergyman. It is well to get a clear idea of this at the beginning in following Rolleston's career, which cannot be understood without it. But it must also be understood that to him the good of theology consisted in its being the vehicle of morality. It was one thing to hear him argue with his friend Wickham Flower about Augustine's doctrine of the Fall of Man, but quite another thing if all at once he came on some live question of duty or honour, drawing from him solemn words in tones which showed where the inmost motives of his mind were enshrined. The memory of his early friends shows that in his college days it was already with him as in later years, when he had passed from taught to teacher. He had his great Homeric laugh at a sentimentalist, and his all but ferocious scorn of a charlatan. But let him have a right to enforce against selfish resistance, or a wrong to expose and punish, let him feel called on to attack the oppressor of the weak, or the perverter of righteous dealing, then one might see his eyes kindle and his massive features harden into the attitude of combat, bringing even his shoulders and arms into the first suggestion of battle, truly signalling the mind within. In such real issues, rather than in abstract questions of doctrine, the man and his impulses are to be read. He was a born fighter, ever ready to do battle for truth and right, wherever he believed truth and right were to be found, and needed help from him.

Among the records of Rolleston's Undergraduate days are letters written to his friend Miss Mary Beever, a lady whom he used to visit in her house on the side of Coniston, and who in an auntly manner encouraged him to correspond with her in the old-fashioned serious way. Letters written in men's student days ought to be thus kept, showing as they do the growth and

shifting of crude opinions formed as each new aspect of life opens on the mind, to be strengthened or displaced as the ultimate resultant shapes itself. To the writer of these pages, who knew Rolleston well, but not till middle age, when his character had long since set into the sharp lines of liberal and reformer, it is curious to come upon him reading Macaulay's Essays for the first time, and remarking, 'He is rather radicalised, and is full of Progress and Whiggery, but in other respects is most delightful.' And again, 'What a charming history Alison's is. I almost wonder at people's taste for novels.' 'I cannot see how the most fervent admirer of Carlyle could ever be so far carried away as to enter him into competition in a historical contest with Alison.' In his second year he describes a characteristic University scene:—'Last Sunday I heard in the beautiful Norman ante-chapel of Christ Church the man whose name Evangelical ribaldry has so long applied to all not of their own persuasion, which meaneth that Dr. Pusey preached. There was an immense crush, perilous indeed to the bones of all therein engaged, caused by those who were eager to hear him. The whole Cathedral, *i.e.* all used for the University, was filled in the space of three minutes completely as regards seats. Such is the regard the University of Oxford pays to a man humble in guise, holy in demeanour, self-denying in life, whom, however, the irreverent Dissenter and robed Schismatic scruple not to call a Jesuit, a Papist, a hypocrite. The pith of his sermon was intended to show the truth of the fact that evil shall hunt the wicked man, and that sin always in this life even superinduces an adequate punishment. And yet, which you, I am afraid, will hardly believe, there was no reference, as the "Record" would say, to inanimate mediation, such as that of Crucifixes, etc. However, I am afraid that though there was no impression of the cloven foot in the sermon, yet Puseyites would not be so called if their Founder were not like them.' By 1850 his ideas had swung into a direction nearer that of his after-life:—'Though I take now, for the present, little interest in anything not immediately connected with my reading, I yet every now and then catch

distant sounds of latrations from without. There has, I see, been a meeting in London of High Churchmen, who have been very vigorous and amusing. The triumph of Low Church, the religion of a northern democracy, is only one step forward in the race of Liberty which this century has witnessed. If bigotry had carried the day it would have been a violation of the spirit of the age, and its triumph would not have been permanent. And the defeated party, not seeing this, not knowing when they are well off, nor understanding in what utter ruin they and the whole Church would have been swallowed up if the result had been otherwise, are enduring indignation and unknown pangs. The man who has an eye to see the movements, an ear to hear the voices of the age, cannot doubt that the spirit it breathes is Individual Freedom, Individual Responsibility, and National Progress. And then, seemingly as much out of place as a figure in chain armour in a modern banqueting-room, do we see the reactionaries struggling against the stream which flows past, uninjuring while unprovoked. The apex of the Delta should meet the stream, not any one of its three longitudinal boundaries. If so, by constant alluvial deposit it becomes assimilated: if not, it is overwhelmed by the outspreading of the waters. This latter course seems to have been chosen by the present champions of Despotism. But who is so free from prejudice as to be able to read aright the spirit of the age he lives in? We have not yet left off quarrelling about the characters of Pericles and Cimon, men who lived 2000 years ago, and are out of the sphere of party passion and interest. There is no hope of wide views for present times. "If we had lived in the days of our fathers," said the Jews of old, and we say now with equal truth. The Tory party now (for a High Churchman on any other principles but Tory is a Centaur) is not content with building the sepulchres, it would raise the ghost of the monsters who received a deadly hurt now 200 years ago at the hands of their ancestors. My most favourite subject of contemplation at present is the fight made for the principles of Liberty at the beginning of this century. Dark clouds seem

to rest over it, and in the midst of it are to be seen moving great figures. At present we are so close to them that they only impress us with our own littleness, not with their greatness. We are like the travellers at the foot of the Sphinx: its real size, its true proportions, are only seen at a distance. Though distance takes away from the distinctness, it adds to the majesty of its features. Now look at Arnold. In a profession in which liberal opinions were a sure bar to preferment, he stood forth as an uncompromising advocate for freedom. His views were distorted neither by prejudice nor by precedents, by establishments, nor by interest. As dispassionately as the mathematician he proposed his problem, and as calmly he declared the result, careless of everything but truth. "By the one party accused as mystic, by the other as infidel." The man rises before us like a granite mountain, and the crows and choughs around its base show scarce so gross as beetles. The mean man could not explain, the weak man could not comprehend, his conduct. To me there is no subject so pleasing and none so ennobling as the triumph of will over interest, and the victory of conscience over expediency. But I shall tire you with my opinions . . . .'

In 1850 Rolleston took a First Class in Classics, and next year was elected a Fellow of Pembroke. The fellowship which he took was the medical one lately founded by Mrs. Sheppard, and this circumstance was the turning-point of his life, determining him to take to Medicine as his profession. It is a good index of the change of educational ideas within the last generation, that one meets with no letters to or from Rolleston at this time complaining of his having spent four of the most receptive years of his life exclusively on classical studies, hardly in the remotest degree bearing on his future profession. Under the present system a student looking forward to the career of Medicine does not abandon altogether the literary culture which is the University's heritage, but he soon ceases to devote his whole time to letters, and passes on into the special lines of science suited to form the ground-work for his future profession. Only men of exceptional energy and capacity

could afford to start so heavily handicapped as Rolleston, and it is no wonder that he laboured in after years to widen the academical course into a system more perfectly adapted to meet the needs of the age. As for himself, he overcame by sheer thoroughness the difficulties of beginning to learn physic at two-and-twenty, entering as a student at St. Bartholomew's Hospital in October, 1851. A remark by his friend Professor Turner, the present editor of his scientific papers, shows how new a turn his mind had to take. Mentioning the high value Rolleston attached to his training in the Chemical Laboratory under Dr. Stenhouse, Professor Turner, who was his fellow-student there, adds, 'It was there probably that he grasped the meaning of scientific method, and was brought face to face, for the first time, with an experimental science.'

The Master of his College gave him a piece of parting advice, that one who was to prescribe ought to begin by making up prescriptions at an apothecary's and becoming a practical judge of drugs. That he did go to work in this way is still remembered at the Hospital, for Sir James Paget writes of him thirty years later: 'When Mr. Rolleston came to St. Bartholomew's Hospital, his age and his standing in the University placed him among a comparatively small group of the senior students; he would not enter into any of the school competitions, but he gave himself at once to the regular work of the Hospital, and to its most practical studies. He intended to practise, and he learnt everything, even of the simplest kind, that might be useful. One might have thought that he intended to make himself a merely practical man. Yet he never gave up the pursuits of science and of literature, and could be provoked into declaring a resolve that he would be a Fellow of the Royal Society in ten years, and he was so.' University men were few at Bartholomew's and kept somewhat aloof from the rest. Rolleston lodged for part of his time with another Oxford graduate, now a physician in Oxford, Dr. E. B. Gray. Their rooms were in Dyer's Buildings, Thavies Inn, on the left hand as one goes up Holborn, where they led a diligent but uneventful life. It was Rolleston's habit after his

day's work in the wards, to turn a few yards out of his way on to Blackfriars Bridge, where, standing in one of the recesses, he would face the wind for half-an-hour and then go home to dinner. The robust appetite that had been gathering since breakfast had then to be satisfied, the 'Times' to be read, then an hour's heavy sleep, followed by a huge basin of strong tea to wake him well up for bookwork till 12 or 1. Such a diet, unlightened by the ordinary idleness and pleasures of the medical student, probably accounts for a good deal of the disordered constitution of later years. Sometimes he visited his friends; for instance, there is a mention in the 'Diary of Henry Crabb Robinson' that in 1852 Rolleston came to breakfast with him to meet 'Nineveh' Layard. But amusement seemed hardly even to occur to him. The only change in the week's hard round was on Sunday, when at this particular time he gave his thoughts a new turn by reading through Gibbon, storing his memory with sonorous passages which he could recite *verbatim* to the end of his life. In the afternoon the two friends would often go down the river and walk in Greenwich Park. Anything less like the received idea of the medical student away from the wards and dissecting-room, it is not easy to imagine. Rolleston's was a grimly serious career, and he left the Hospital with the reputation of one of its hardest workers. Never trying for prizes or distinctions, nor attempting any original research, he simply worked for knowledge and experience of medicine. The practical knowledge he had gained under Sir George Burrows, whose clinical clerk he was for some time, stood him in good stead when almost immediately his opportunity came of carrying it into practice. In 1855, toward the end of the Crimean War, he was appointed one of the physicians to the British Civil Hospital at Smyrna. The Master of Pembroke wrote him a letter of good advice, very characteristic of the writer. 'You have profit and employment in what would otherwise be the dead time in your career, possibly an avenue to something great and permanent . . . You will now be under official trammels. Pray be discreet as to your words. Speak

not too strongly of things, nor strongly at all, especially in the way of blame, of men. When you are called upon officially to express opinions, then praise or blame with justice and moderation, till then only look, think, and obey cheerfully.'

The position which Rolleston had taken was one peculiar enough to justify the counsels of Dr. Jeune. The Smyrna Civil Hospital, established at a time when the lessons of disaster were bringing about an improved military administration, is thus described by Kinglake ('Invasion of the Crimea,' vol. vi. p. 416): 'Amongst our Levantine hospitals, the one formed at Smyrna exhibited the success of a great innovation on which Mr. Sidney Herbert had ventured; for the medical officers to whom he entrusted the wards were, all of them, civilians, and these, aided by a well-chosen band of ladies and salaried nurses, made the new institution a model of what can be done for the care of troops sick or wounded.' Such an innovation naturally had its official difficulties. General Sir H. Lefroy, who made two visits to Smyrna in November, 1855, gives some account of Rolleston's position. Colonel (afterwards Sir Henry) Storks was then Commandant, and Dr. Meyer Medical Chief of the British Chief Hospital. On the Medical Staff there were four senior physicians, each in charge of a division. Dr. Meyer found these gentlemen of little use, too old to alter their habits. Many of the young assistants were first-rate men, and conspicuous among them was Mr. Rolleston. The Seniors made endeavour to treat the Juniors as subordinates in a professional sense, to work as clinical clerks under them. This the young men would not submit to, and the good sense and firmness of Dr. Meyer put a veto upon it. He gave them the undivided care of cases, and looked to the Seniors for general assistance only. He found the junior surgeons, he told me, pretty good physicians, and the junior physicians pretty fair surgeons. The division into physicians and surgeons, but with no very rigid demarcation, was found to work well.

Some of Rolleston's home letters have been kept, which show what his hospital life was to himself, and the recollections of

one of the lady nurses, slight as they are, may give an idea of what he seemed to others. 'During the nine months that I spent in the Hospital at Smyrna, I nursed almost exclusively under him in the Division confided to Dr. Leared's and his care, so that I had constant opportunities for understanding his fine character, so full of talent and energy, so kind, and with so much earnestness beneath his playful manner. Looking back I see a tall slight fair young man moving up and down the long corridors lined with the beds of the sick, and the wards opening from them, giving his orders clearly, attending to every case most carefully, always kind and cheering in his manner, and most pleasant and considerate to those working under him. . . . He was very successful in "fighting the fever," as he used to call it, and for a long time his Division was mostly filled with such cases.'

On May 25, 1855, the young physician writes to his sister:— 'Everything just now wears the *couleur de rose*. The last few days of April we got our hospital nearly empty; and the first six days of May brought us down two shiploads of sick from Balaclava. The first ship, the "Sydney," steamed in on the 1st of May about 10 A.M., ran out her anchor and ran up a yellow flag about 300 yards out away from the Hospital. It was very exciting. We found however that the cases she brought down were not so serious as had been expected; and the second ship, the "Brandon," which came on the 6th, had still fewer cases on board. Matters, in fact, are improving in the Crimea, and we have not now the wretched depression and utter prostration to deal with of which we had so much in March last. It is a short three weeks since these arrivals took place, and the Hospital is rapidly assuming the appearance of a convalescent establishment again. Can anything speak more strongly for our organisation and sanitary condition? The English have put unbounded means at the disposal of the authorities everywhere throughout the Levant; we, here at Smyrna, have made use of them, and the results will justify the expenditure. Elsewhere, I believe, the good things sent out

have never reached their destination, and that makes all the difference. For my own part, I have not often had such a continuance of good health and vigour. For the last six weeks I have had Dr. Martin's wards as well as my own to take care of, and I never found myself the least overworked, even at the time the two sick ships came down. It was of course a great advantage to get so much practice put into my hands all at once, and, by a little management, I contrived to get a very large share of what are called "good" cases (*i.e.* dangerous ones) into my own wards. At the present moment I have as many of these cases, more, I think, than anyone else. Of the first lot (16 or so), one died in about 36 hours after landing: the rest are all doing fairly. Very few deaths have taken place lately, I don't think more than one this week. We have in reality about 750 soldiers here, though the papers speak of us as having only 500; our hospital has only 500 men in it, but it has a Convalescent establishment as well, which no other hospital has, so that they keep and count their convalescents whereas we send them off one mile to the Lazaretto and do not count them in our sum total. Hence our mortality is really very low. . . . I have plenty of time for visiting and flirting, and reading to boot. In fact I have read more medical books since I have been here than I could have done anywhere else I think, also I have contrived to find an outlet for some of those social qualities which go towards making up the entire man.' After a while, finding himself with nothing to do, Rolleston came to Sebastopol to offer his services, but Dr. Hall told him he had more doctors already than he knew what to do with, so 'I resigned myself to sight-seeing for my fortnight's leave of absence. In the three days I have had here, I have seen Balaclava, Inkerman and Sebastopol. I have got clear notions of what war really is, which you cannot do from books or prints (though the Redan and Malakoff are very like their pictures in last week's "Illustrated"), and I have gone over those famous fields and collected trophies with my own hands from them. Also I have heard the whistling of the round shot which the Russians fling

at one from the north side. Sebastopol in the distance looks very beautiful, it has a grand Grecian building in it, like the Madeleine in Paris, which strikes the eye, as well as large barracks, hospitals, forts, etc. The south side is built on ground sloping up inclined-plane fashion from the harbour up to the south sea-board which is cliff like the south coast England, north coast France cliffs. When you enter it you are struck by the utter destruction of what seemed so fine, shots lodging in walls or great holes knocked through them, no floors, no roofs, and finally a horrid smell telling of those brave men who slumber there below. The town has not walls, and is not fenced up to heaven, but has round knolls, mamelons, lying off at a little distance, made up into earth-works, great banks of earth with embrasures for myriads of cannon. The Russians were brave men to cross the valley of Inkerman, a great deep valley with a mile of level ground between on our side of it. Down the same hillside did they descend to the bridge of Praktin, from the same hillside did they yesterday fling their shot over Philip Rolleston's and my head as we rode over the hillside collecting relics. Oh! how thick the bullets lay in particular spots. I saw some oak-leaves gathered on that ground: you know it was all covered with brushwood where the battle was fought; all has been grubbed up since and burnt. All the battles which have been fought would, if their result had been different, have decided the fate of our army. The battle of the Tchernaya was meant to cut us from Balaclava, and how the shipping would have blazed in that narrow winding valley, so at Balaclava and at Inkerman. Near indeed was the whole army to utter destruction.' In December Rolleston was back again in Smyrna, taking one day a week at the hospital, reading medicine, riding across a country well provided with ditches and stone walls to the vineyards, attending a single lady patient, and wishing for more work. Some work was found for him, as appears from some further notes by Sir H. Lefroy: 'There were 200 vacant beds in the hospital, and the object of my mission was to arrange, in conjunction with Col. Storks, for closing it entirely.

Chiefly however in consequence of the great ability of a few of the Juniors, and I again remark that Mr. Rolleston was the representative man, we determined to retain the services of four of them, viz. Messrs. Rolleston, Wilkinson, Eddows, Atkinson, as a reserve of medical strength, and to meet contingencies. This fortunately met with Lord Panmure's approval, and it was to give them something to do, and to utilise the time, that the plan was hit upon of calling for a Report on Smyrna in reference to the sanitary and other aspects of the place. They received, I think, no particular instructions, but they collected a great deal of useful and valuable information, which is embodied in Mr. Rolleston's Report, dated Nov. 1, 1856. The abrupt termination of the war consigned it, like many other Reports, to the waste-paper basket.'

The Report which thus came into existence is probably even now the best guide-book to Smyrna which a traveller or merchant could have. Among other matters, the writer's experience enables him to write with authority on the malaria-fever, the terror of Europeans in the East. Comparing the conditions of Ephesus, where it is said that no European can sleep without contracting a fever, of Mersina, the port of Tarsus, and of Alexandretta, where the inhabitants sleep in wooden cages set on poles 10 to 12 feet above the earth, he comes to the conclusion that the one effective condition for generating malarious fever is not abundant vegetation, is not marshy soil, nor any one season of the year, but marshy ground in the process of desiccation under the influence of solar heat. The one condition common to all three places in question is marshy ground, nearly or quite exhausted of its moisture by solar heat. As an illustration he quotes a warning given him by a Consul at Tripoli to avoid mulberries, because all experience shows that they cause the pernicious fever. Now logically, this caution was an instance of that commonest of fallacies, *post hoc propter hoc*, but scientifically interpreted it contains a certain amount of truth and should be thus read; the sun has just got power enough to ripen the mulberries; the marshy ground will be now

just on the point of complete drying, and malaria, consequently, just in the prime of its strength. In discussing the various nationalities of Smyrna, Rolleston claims the Greeks there as genuine representatives and descendants of the ancient Hellenes. The characteristic bearing and expression of the old models of Greek art are, he says, constantly brought before our minds as we meet the modern Greek in the streets. The seafaring Greek seemed to him like the Odysseus of the ancient sculptors, not only in general expression, but in details of limb and feature, lips, nose, eyes, hair, and forehead. The Greeks of Asia Minor have been much less intermixed with foreign blood than those in Greece Proper, and kept their Romaic speech even when Albanian was spoken in Athens, and πᾶσα ἡ Ἑλλὰς ἐσκλαβώθη. Nor have the Anatolian Greeks adopted the Albanian fustanella or kilt, as the modern Hellenes have done, but wear the loose blue calico breeches, the jacket, and the long loose red cap like the Phrygian. As to the national qualities of Greeks and Turks, so important a factor in the politics of the East, the report is scrupulously fair. This comes out clearly and also quaintly in an appendix on a Turkish industry, the making of fig-drums of bent wood. Of course the square shape is better for packing, but a remark is added that the shape of the box depends on the orders of the exporter, so that it is incorrect to ascribe the persistence of the round shape to the obstinate and irrational preference for that which is old, simply because it is old, which the Turk really does show in so many instances. Rolleston had soon seen enough of the Turks to understand the hopelessness of turning them into a civilised Western nation. The declining glory of the East was everywhere plain to him. 'The war,' he used to say in after years, 'has killed the old reverence. How can it last? I saw a quite grand old ragged sheikh, a sort of Turkish Quixote, at the head of his little troop, come down to the beach on his mule just as some French and English sailors were going by, and one of the Frenchmen, egged on by one of our tars, went up to the old fellow and gave his beard a pull.' A letter, written as late as

Dec. 22, 1877, to his friend the Russian archæologist, Baron de Bogushevski, describes the change of political ideas which experience of the East brought about in his mind: 'Well, Plevna has not delighted you more than it has me; I have read all the accounts which I have been able to read with as much pleasure as I ever read any account of any English victory. It is a most grievous thing for any wholesome mind to regard with sympathy incarnate cruelty and lust, which sympathy with Turkey represents; and it is a very painful thing for any patriotic mind to know that a party sympathising with such lower forms of life as Turkey and her social institutions and traditions can be found among his own countrymen. But I ought to say that I was once nearly as great a savage as these my countrymen are now. I was a "Civil Doctor," *i. e.* a Doctor sent out to the General Hospitals, as you have been told, during the Crimean war-time, and I recollect an older and a wiser man saying to me, that it was wholly wrong of us English to be fighting for the Turks, Christians as we were, against you. At that time, it was early in my experience of Turkey, I was quite surprised and shocked at this view, which however I came to see was right, after seeing more of the filthy barbarians than I had then done. I was set to write a Report, which was printed, though not published, by our War Office, upon the whole of what I had seen during the whole time I was in Government pay, and in that what I thought and said of the Turks was much what I should say now after visiting Turkey again in 1871. Most Englishmen however, as a rule, know nothing whatever of the Turks, their principal ideas being drawn from the pictures they see on pickle-pots of a fellow in a turban and loose breeches swallowing a fish whole! Indeed they are in much the same Stygian darkness that I was in myself till I saw them for myself. I am sending you through your agents a number of the "Contemporary Review," in which there is an article by my great-idol, Goldwin Smith, on our state of mind as to this business, and you will see that the same men who were on the side of slavery and brutishness, and the lower

civilisation generally in the American North and South war, are still true to their Devil-Worship.'

Rolleston's service in the East came to an end in 1856, when a letter to his sister from Alexandria, June 12, shows him returned from a tour in Palestine, and on his way back to England. The next year he held for a short time the appointment of Assistant-Physician to the Hospital for Sick Children in London. In a letter to Miss Beever dated July 5, 1857, he writes of his disappointment that the Smyrna Report was not to be re-printed as a Blue-Book, but he was looking forward to taking his M.D. degree at Oxford, and fully occupied. 'I see on an average about 60 fresh cases of children from a few days old up to 12 years every week, besides old cases. You will see that this is a fair field for labour, and I hope to be allowed to be of some use to my fellow-creatures in my generation. I strive certainly to do my duty, and if God gives me health and strength I hope to continue to do so in this post for some time. . . . I see a good deal of the London poor by this means, and though I find among them much stupidity and brutishness, I nevertheless see more of qualities which are estimable. Love and self-denial I see constantly, and I make it my business to encourage these qualities and to prevent their being neutralised as they so constantly are by ignorance of the very commonest things. I don't at all object to saffron, which is given by most London mothers for most diseases in perfect faith, but I wage daily war against veal and bacon, pork and cheese, for infants of seven months old and upwards. Some mothers I find, with the greatest affection for their infants, still will not ever become sensible that special emergencies need special practices, and that habits, however old-established, must under critical circumstances be broken through. They resemble the authorities in the late war, who sacrificed 10,000 lives rather than re-arrange their habits. A child I find, out of the Hospital of course, who requires attention from one hour to another, will get it till 10 P.M. when its mother goes to bed, but no longer, unless great pains be taken to drive in the notion that mother's habits and

child's necessities may occasionally clash. What a rare event the acquisition of a new notion must be however to the working classes with their dull grey life. Their minds are as unused to it as their stomachs to turtle, and are as little able to bear with it. But among my own friends I can count several men of great acquirements and education in the past who have reached the happy stage of finality and never take in any new notion whatever. It seems to be a painful process to them—even the very attempt to do so. This is a Whig state of mind, and while it is to be found in the upper, what are we to expect in the lower classes of life? However, after all, even the exercise of my powers of persuasion as distinguished from those of prescription is attended with pleasure, except in the case of the Irish, whom I have long learnt to consider as unamenable to reason or indeed anything else.' A few weeks later he continues, 'For my own part, I am working at my Children . . . They are very interesting in many ways, having first of all less of the tarnish and soil which longer life in this world never fails to smear over us, and secondly having the claims to pity which in addition to those which all sick folk have, they possess, as suffering without having brought their suffering on their own heads by their own fault. The people I object to are husbands; their cruelty and savagery are very great obstacles even to the bodily health of their children, and are totally destructive of everything else of a higher kind. But this I do not see so often as I see self-denial and exertion on the part of the wife, indeed these qualities are called for whenever the husband is of the above kind, and on many other occasions also. Every now and then I find women taking care of children whose mothers cannot, from disease or poverty, though they themselves are only one grade better off. This is most pleasing, as proving the existence of real goodness, as poverty allows of no luxury, not even of the luxury of doing good. Supporting and feeding another person's child gratis is something for people to do who buy fresh meat three times a week, and their tea and sugar by the quarter-pound.' This letter is dated 13 Henrietta

St., Cavendish Square, where the now Dr. Rolleston had his name on a brass-plate on the door. But the prospect of a London physician's life was to change very soon to a different view.

Before the end of 1857, the death of Dr. Ogle, Physician to the Radcliffe Infirmary at Oxford, brought Rolleston back there, armed with a pamphlet full of praises from medical authorities. The laudatory flavour of testimonials makes them, when their occasion is past, as hard reading as epitaphs, but there is a sentence in one of these from Dr. Jeune, which must be quoted as recording a notable moment in Rolleston's earlier Oxford career:—'That on leaving Oxford, to follow his medical career in London, he took with him his vigorous application and quick perception, was proved by his Examination for the Degree of Bachelor of Medicine; at the close of it, the three Examiners, all men of celebrity, rose and publicly thanked him in my presence for the Examination which he had passed—an unprecedented distinction.' It is not surprising that Rolleston's friend who was his one serious competitor retired, leaving the course free for him. The same year Dr. (now Sir Henry W.) Acland (one of the three examiners above mentioned) was made Regius Professor of Medicine, vacating the Lee's Readership in Anatomy at Christ Church, whereupon the Dean and Chapter appointed Dr. Rolleston his successor. This office is one of historical interest, as the germ out of which the Science School of Oxford has been largely developed. In 1765, Dr. Matthew Lee founded at Christ Church a Museum of Anatomy, in the building where now is the Chemical Laboratory. But it was not a flourishing foundation when Dr. Acland came back to Oxford to be installed as Reader, and found himself master of the gloomy musty room where a human skeleton hanging by the top of its head to an old brown cord was conspicuous at once as apparatus and ornament. Scarcely any one ever came into this old-world place to inspect the anatomical preparations which embodied the then most advanced Physiology. Dreary as was the outlook of Natural Science in those days, the new period

of growth had begun. The extensive series of dissections made under Dr. Acland, out of which grew the present collections of Comparative Anatomy in the University Museum, had laid the foundations of its Biological department, and when his Readership passed on to Dr. Rolleston, the almost extinct teaching had become a reality in the University. Rolleston carried on the work between two and three years, and a proof of his success in carrying his class with him may be found in the remark of Professor Bartholomew Price, that although the Pembroke students were now no longer bound to attend Professors' lectures, the number of the Lee's Reader's auditors increased instead of falling off. Rolleston began by the usual medical combination of private practice with teaching, and he seems to have been popular as a physician, but as time went on he came more and more to see that his work had to be done in the world rather as an instructor than as a practitioner. A letter he wrote to his sister on Dec. 24, 1859 (he was then living at No. 5, Broad Street, Oxford) is a good example of his manner, while its ending shows how his mind was settling on to its permanent lines. 'I have at this moment in my care a girl of 14, who has had a very bad fever with relapses . . . but is very likely to get sound and well. The people of this part of the world have very low wages in the country villages, and are in consequence as brutish as can be imagined. This child is half Pig and half Tiger-cat. The other day I was poking a stick of caustic into her throat to stop an uvula cough, when, as I withdrew the holder, she snapped at it like a dog snapping at a whip. She gripped the holder, set the caustic-stick free, and down her throat it went. By Jove, you should have seen her face as the burning stick went down. There was not a moment to be lost, and I got a salt-cellar full of salt and poured it down her throat to neutralise the nitrate of silver. As the salt got down the pain left her face, but I was in an awful fright. So was she, but the Tiger-cat soon awoke again as the pain ceased for the moment. But there was a good lot of nitrate of silver I knew as yet unneutralised, and getting a wooden peg I poured salt

and water down for about twenty minutes. She was too weak to be sick or less would have done. No evil followed. Was not that fine practical Chemistry? She has lived through it all, and is likely I should judge now to live, as if that business could not nothing else is likely to kill her, and she is now on Quinine and Cod-liver oil, and the Pig-nature is showing itself, salt having killed the Tiger-cat, as salted meat usually does the Carnivora. I dwell on this professional bit of my life, as the Professorial is now so much overlaying the former. It is very demoralising this having to work two lines simultaneously, but I think I see my way now toward getting rid of the former of the two. Possibly this confession, which I do not wish to be made public, may cause you to lose any little confidence you might have had in me in my capacity of Practising Doctor. I will send you by this post, however, an Oxford almanac in which you will see me to full extent in my Professorial capacity, and being at the same time always at your service in the other too, I am your affectionate brother.'

The new move which was to make Rolleston's future career one of instruction, was his appointment to the recently created Linacre Professorship of Anatomy and Physiology, an office belonging to the great scheme of development of Science in Oxford, which was just becoming embodied in the University Museum. This was, from the first, not a museum in the modern sense of a collection of rare and interesting objects, but rather intended to realise in nature as in name the idea of the original Museum of Alexandria, where mathematicians, astronomers, and chemists were gathered together under the same roof engaged in research and teaching, where an anatomical school formed the basis for the education of physicians, and a great library put within the student's reach all the knowledge hitherto amassed. Such a Museum of Science the authorities of the University established, not without many difficulties by the way, for the ornate building in which Mr. Ruskin's ideas found expression proved of vast cost, so that the economical resistance of financiers mingled with the disfavour of those who were jealous of putting

Natural Science on a par with the old learning. In 1860 the central hall and galleries were opened for the collections which were to provide materials of instruction, and the lecture-rooms for the professors who were to convert these materials into scientific education. Christ Church removed its Anatomical Collection to the University Museum, and the Lee's Reader in Anatomy migrated with it. Dr. Acland induced the Radcliffe Trustees to move the Radcliffe Library thither also, that the Museum might have the best provision of scientific books, while at the same time the Camera, where the Radcliffe Library had been housed, was set free for the more general purposes of a reading-room and annex of the Bodleian. Merton College, having a large fund available for the promotion of Medicine, took the judicious course of creating the Linacre Professorship of Anatomy and Physiology, also within the walls of the Museum. When this Chair was founded in 1860, Dr. Rolleston was elected its first occupant, and held it through life. It was a stirring time in the history of Biology when he began his work. Darwin's 'Origin of Species' had set men's mind in movement, though whither this would tend was not yet seen by all. It was destined not indeed to carry Rolleston's mind altogether in its stream, but to shift the direction and force of the current of his thought. A letter to his friend on Jan. 19, 1860, shows him swaying under its first impulse: 'I don't see that you mention Darwin's book; everybody is reading it now and here, and I think if the book were a little better arranged it would make a good many converts. If the chapter on Classification, which is now last but one in the book, were put first, the book would be much more read. As it is, many people are deterred from reading it by the great difficulty of mastering his meaning, as he writes as curtly as Bishop Butler nearly. I am very much amused to find the Hyper-orthodox Americans of the North are driven into unison with the Southern Slaveholders in one point by their fear of Lamarck and the 'Vestiges of Creation.' They have out of utter fear of these views gone into the other extreme of multiplying specific

centres of creation enormously, and laying it down as an axiom that man was created at different centres of creation, just as they hold other animals to have been. This for the Northerns: of course the Slaveholders join in with great earnestness. The other day, a Black Prince came to my Museum, especially to discover whether his brains were constructed on the same plan as those of the white races. Some Americans had told him the two things were quite different. Without being a Darwinite to the entire length he goes, I cannot avoid being one as far as man goes. . . . As it seems to me, however, Archbishop Usher's chronology and the doctrine of the Human Race are non-consistent, and you must give up either St. Paul on Mars' Hill, or the Archbishop as he wrote in Dublin. I am very full of Ethnology just now and am collecting human skulls from all parts.' The interest in the early history of Man thus awakened by the problem of his relation to lower animals as raised by Darwin, came before Rolleston's mind a few months later in a more intense and personal form, in the Zoological Section of the British Association, at a memorable meeting, which Professor Acland, who was present also, mentions twenty years after in his obituary notice of his friend. 'It so happened, that in 1860 a circumstance took place which tended materially to concentrate all the qualities of his nature on the highest biological questions, whether considered from the material or psychological point of view. The British Association met in Oxford, and the famous discussion on the hippocampus in the brain of man as compared with that of the higher apes took place between Professors Owen and Huxley. Bishop Wilberforce brought, as is well remembered by all scientific men, the forces of his ready wit and great reputation to bear against the sincere statements of the younger anatomist. Rolleston's indignation was fired, his sense of justice made him throw heart as well as head into the cause of what, at the moment, seemed the weaker man. It is not possible to say now to what extent that brief scene influenced the ardour and imagination of Rolleston. Be this as it may, all prejudice and even bias derived from the most

refined Oxford culture was banished from his mind in dealing with the nature of man.'

The controversy here referred to, one of importance in modern scientific history, lasted several years. It arose at the Oxford meeting just mentioned out of a botanical paper by Dr. Daubeny on the Sexuality of Plants, which went into criticism of Darwin's 'Origin of Species.' Professor Owen, in the discussion which ensued, took up the question of differences between apes and man, asserting that the brain of the Gorilla presented more differences as compared with Man than with the lowest Quadrumana. This was met by Professor Huxley with a flat denial, he declaring that the brains of man and the highest monkeys differ less than the brains of the highest and lowest monkeys. Rolleston does not appear to have spoken at this time, nor on the occasion a day or two later when the Bishop of Oxford received a famous rebuke for the rhetorical device of perverting the Darwinian theory in order to make fun of it. But this problem of brain-classification became an especial subject of Rolleston's study, and in January 1862 he delivered a lecture upon it at the Royal Institution, which is republished in the present volume. At the Cambridge Meeting of the British Association in 1862, Professor Owen renewed the contest, bringing it to a direct issue by reading a paper 'On the Zoological Significance of the Brain and Limb Characters of Man.' Appealing to his own system of classification of the Mammalia by differences of brain structure, he exhibited casts of the brains of gorilla and man, saying that he had placed Man—owing to the prominence of the posterior lobes of his brain, the existence of a posterior cornu in the lateral ventricles, and the presence of a hippocampus minor in the posterior cornu—in a distinct sub-kingdom, which he had called Archencephala. He considered that the sudden advance of the human brain, and the hiatus between that highest grade of structure and the next step below attained by the orangs, chimpanzees, and gorilla, was one of the most extraordinary in the whole range of Comparative Anatomy, associated with Man's intellectual capacity, his power of framing general propositions

and of expressing thought in articulate speech. Professor Huxley answered that he had controverted the assertions made for years by Professor Owen as to the differences in brain between man and the highest apes; he called upon Professors Rolleston, Flower, and Vrolik, to say whether the universal voice of Continental and British anatomists had not entirely borne out his statements, and refuted those of Professor Owen. Professor Rolleston on this went into the whole question on its merits, in a speech which, putting together the newspaper reports and his own notes, seems to have been somewhat as follows:—He said that the facts stated by Professor Huxley were supported by the evidence of the photographic process, referring to the 'Natural History Review' for April and July 1861, and to his own Royal Institution lecture above mentioned. He would try to supply the members of the Association with the points of positive difference between the human and the ape's brain. For doing this we had been abundantly shown that the hippocampus minor and the posterior lobe were insufficient. Without employing that analysis of the brain's convolutions which we owe to Gratiolet, it is impossible to differentiate the brains of man and the apes fully and fairly. Professor Owen had himself spoken of the determination of the difference between Homo and Pithecus as being 'the anatomist's difficulty.' It was plain, therefore, that the differentiation of the human from the simious encephalon was not such an easy matter as many persons might suppose, and it was but recently that the means for effecting this differentiation had been discovered. What Gratiolet had done for the anatomy of the brain might be compared with the work of Adams in astronomy, and of Max Müller in language, and without a reference to his writings it was impossible for a lecturer on this subject to treat either it or his audience fairly. This analysis had enabled us to point out great differences, and widely-swerving characteristics, which the rough and empirical methods of ordinary brain anatomy were wholly incompetent to reveal to us. On Mr. Darwin's principle of the great importance of rudimentary organs for classificatory pur-

poses, which the schoolmen had expressed in the wider words '*Nusquam magis quam in minimis tota est natura*,' and which we might express in plain English by saying that 'Small things speak plainly of great issues,' the general public had been right in clinging to such a structure as was the hippocampus minor as a mark and means for differentiating man from the apes. As, however, this nodule of neurine had been rent away from their hands, it was right that something should be supplied to take its place. The analysis of the brain's structure had established as differentiative between man and the ape four great differences—two morphological, two quantitative. The two quantitative, which we can detect without having recourse to Gratiolet's method, are the great absolute weight and the great absolute height of the human brain. The two morphological are the multifidity, the great complexity and evolution of the frontal lobes corresponding to the forehead, usually, popularly, and as this analysis shows, correctly, taken as a fair exponent of man's intelligence—and the presence in the apes and absence in man of the deep cleft, 'the external perpendicular fissure,' in the posterior part of the hemispheres. No reference to these important matters of Gratiolet's analysis had been made by Professor Owen, and this omission could not fail to put the British Association's repute for acquaintance with the work of foreign fellow-labourers at great disadvantage in the eyes of such foreigners as might be present. Professor Rolleston concluded by saying that if he had expressed himself with any unnecessary vehemence he was sorry for it, but he felt there were things less excusable than vehemence, and that the law of ethics and love of truth were things higher and better than were the rules of etiquette or decorous reticence.

Among the notices of this speech of Rolleston's, which made considerable impression, is a mention of it in Kingsley's squib 'Speech of Lord Dundreary in Section D. on Friday last, on the Great Hippocampus Question.' This, which rather well represents the perplexity of the lay mind at an abstruse anatomical disputation, is republished in Kingsley's 'Life,' chap. xix, and followed by a letter written to Rolleston by Kingsley (Oct. 12, 1862), who

found in some remark of Rolleston's a support to his own belief that 'the soul of each living being, down to the lowest, secretes the body thereof, as a snail secretes its shell.' There seems however to have been no more ground for supposing Rolleston inclined toward this mediæval doctrine, than he was to the idea which Kingsley asks him in the same letter to reconsider, that the gorilla and baboon brain are degraded forms (apparently from the human). A few days after this, Rolleston writes an elaborate letter to the 'Medical Times and Gazette' (published Oct. 18, 1862), giving particulars of his own late speech, continuing the argument on brain-classification, and ending with the following paragraph as to the bearing of his scientific research on his religious belief:—'I may say, in conclusion, that it has always been clear to me that the true relation of man's body to his soul, to the world in which he lives, and to the Governor of it, can never be fully elucidated either by physiological or psychological researches, nor yet by both combined. The saying of Favorinus, viz.:—

> 'On earth there is nothing great but man;
> In man there is nothing great but mind'—

may be taken as an adequate expression of the results in which such researches by themselves would land and leave us. Nor need we, when writing as men of science, add anything to this dictum of a pagan philosopher. But, thinking in our privacy as Christian men, we feel that this expression no longer covers all the facts within our knowledge, and that events, now nineteen centuries old, necessitate some modifications of it.'

In 1861 Dr. Rolleston married Grace, daughter of Dr. John Davy, and niece of Sir Humphry Davy. For the first years of their married life their home was 15 New Inn Hall Street, a well-preserved seventeenth-century house, said to have been built by Vanbrugh; and in 1866 they moved to a house they had built in South Parks Road, close to the Museum, where the labour of his life went on. Rolleston had now found his way to a position giving full scope to the teaching power by which he mainly made his mark in the world. This kind of power,

real and striking as it may be to personal experience, does not lend itself easily to description. Some accounts written down at different times of his life may give an idea of the memory of him which remains in the minds of the few who taught him and the many who learnt from him. One of his students writes:—'During the years 1868–9, when reading for the School of Natural Science at Oxford, I had the privilege of studying Physiology and Comparative Anatomy under the direction of Dr. Rolleston. . . . His lectures were always most thorough. With a profound knowledge of the subject on hand he combined a happy power of bringing that knowledge within our reach. His voice was peculiarly pleasant, his pronunciation so clear that I never missed a word, though the lecture-room was large and crowded. There was a deep earnestness about his manner, which could not fail to impart a reflection of earnestness to his hearers. He encouraged us to take notes of his lectures, and was particularly careful to insist that we made a fair copy of those notes. This he would look over with considerable attention; on referring to my note-books I am struck with the thoroughness of his scrutiny. Not only did he correct all mistakes, but often filled up omissions, inserting much valuable matter. Those note-books, containing copious additions from his honoured hand, cannot fail to be a lasting and valued memorial of him to all who are fortunate in their possession. He did not consider his duty towards us completed when the lecture was over and its notes corrected. If it was often hard for us to attend the Museum in the Summer afternoons, the hardness was always alleviated by the reflection that "the Doctor" was sure to be there. The Court of the Museum is fitted up with enclosures in which the student finds a table and chair. He draws the curtain and settles himself down to studying the various specimens arranged on shelves round his enclosure. The Book of explanations lay ready on the table, written in Dr. Rolleston's own hand; he was perfectly familiar with the many thousand specimens that the Museum contains. He would often visit us in these hours of private study, and ask if we had any difficulty,

and invite a few of us to look round some case of specimens, and by a little practical demonstration contrive to throw a life and interest into the dead and dried preparations, where before all was dark and unintelligible.' Nor did his teaching cease with Term-time, for in the Long Vacation he used to organise a sea-side working party to dredge and to study the anatomy of marine animals, when the enthusiasm for biological investigation he could arouse in fellow-students and pupils is still admiringly remembered.

The following reminiscences by Professor Louis C. Miall, of the Leeds College of Science, contain an accurate estimate of Dr. Rolleston's qualities as a teacher and lecturer:—'I well recollect my first introduction to Professor Rolleston, then on a visit to Bradford. He found me trying to explore the intricacies of Biology without direction. At that moment I was dissecting a chimpanzee. He took up the subject easily, and spent a great part of two days upon it. No pains were spared in demonstration and explanation; the dry anatomical facts were insisted upon, but enlivened by plenty of discursive talk. To a mere beginner, ignorant and almost helpless, this instruction was memorable indeed, and after fifteen years I look back upon it with deep gratitude. When I had the good fortune to meet Professor Rolleston in after years, he was always full of friendliness; to tell him anything new, or to point out to him a new process, was a service overpaid by the kindest acknowledgments. A question, or merely that attention which it was a pleasure to give, would encourage him to talk on any point of anatomy or natural history, and always so pleasantly and with such mastery of his subject that the lesson was easily remembered. One little trick of manner often amused me. He would give his friend full credit and more for any bit of knowledge which he happened to possess, and would speak deferentially, as if subject to correction, to a man infinitely his inferior. "To you who have studied so-and-so," he would say, "these things are perfectly familiar, but I well remember the surprise with which I learned that," &c. It was useless to protest against this imputation of superior know-

ledge, which a conversation on any subject whatever was enough to refute, and one had to acquiesce in being treated as a kind of authority upon the very subject which he was putting in a perfectly new light. A walk round a Museum with Professor Rolleston was a treat I more than once enjoyed. He would take up topic after topic, some great and some small, and pour out his stores of precise and often recondite knowledge, always delighted to be questioned, and glad of any appearance of receiving information. I remember how once a turn was given to our talk by the chance mention of a piece of rascally cruelty inflicted upon animals. I remember the rush of indignant words, and the excitement which could not abate till he had uttered his passionate exclamation. Professor Rolleston's popular lectures are in many persons' recollection; they were odd in many ways, immensely discursive, often dwelling upon details more curious than important, and overlaying the subject with an excess of illustration. There was always an infinity of unfamiliar matter, discussion of passages in classical historians, quaint applications of the rules of logic, rectification of words, and something of the flavour of the learned and rather whimsical writers of the seventeenth century, such as Burton, Fuller, and Sir Thomas Browne. Two characteristics never failed to redeem these discourses from any suspicion of triviality. The facts were minutely accurate, and they were made to converge upon one point with an effect which was only impaired by their profusion and vivacity.' Such remarks, at once appreciative and critical, will be read with far more lively interest than any mere panegyric. Rolleston was a man whose mind and character were built on a large enough scale to allow of the full all-sided truth being told about him. A further aid to realising him will be found in the judgment of him by his instructor first, and friend afterwards, Mr. Savory, F.R.S., the eminent surgeon:—'What always struck me in Rolleston was his abounding energy, his profuse mental activity. While awake his mind seemed never to be in a state of comparative repose. It was constantly striving at the solution of some problem or other, either in argument or discussion, or in a

long monologue delivered with extraordinary rapidity, to which he had no difficulty in compelling his friends to listen. His exceeding volubility was indeed a striking part of him, and a very characteristic one. He was perhaps the most fluent and rapid talker I have ever known. When elated and once fairly off, his rattle of words was amazing. But although they were poured forth at a prodigious rate, it was evident that they did not come fast enough for his thoughts. In fact, though he rarely talked nonsense, and was oftentimes singularly brilliant in speech, his thoughts and words appeared sometimes to escape from his control. This was most marked in a set discourse or a lecture. He started a subject or a line of thought. Ideas and speculations from all quarters soon crowded in. One after another was taken up and pursued at a tremendous pace, until at length we were watching a torrent of words on some question as remote as possible from the subject which originally provoked it. Thus when once in the Chair at our inaugural dinner on the 1st of October he rose to propose "Prosperity to the Medical School," and in less than five minutes he was discussing with great vehemence the origin of the word "clan." On another occasion he began a lecture, the subject of which was to have been "Ancient Skulls," but towards the end a large part of it was taken up by a criticism of the merits, as a writer, of Diodorus Siculus. This striking feature of Rolleston's intellect goes very far, I think, to explain the character of his work. It was abundant, clever, brilliant, but too diffuse and fragmentary. He touched many things, and most of them with effect, but he produced nothing wholly worthy of himself. He was certainly far greater than he appeared to be in any work he has left behind him. Rolleston was indeed richly endowed in intellectual gifts. He had splendid abilities, a marvellous memory abundantly laden, a fertile imagination, a singularly quick and clear apprehension,—much in his mental constitution which might be called genius, and overwhelming energy; but lacking somewhat perhaps of the power of patient thought, of steady and sustained reflection. His will was not perhaps fully equal to the direction

of his intellectual faculties. The charm of his character, the beauty of his nature, was recognised by all. His heart was worthy of his head. It may go without saying that Rolleston was in a high degree a conscientious man, and he had the courage of his opinions. And who that knew him will forget his tender sympathy with the weak and suffering, his honest dislike of tortuous and secret ways, his manly scorn of all that is mean or ignoble, his delicate sensibility, his subtle humour, his refined taste, his keen appreciation of beauty and of the nobler side of things, his ardent love of truth and his reverence for the highest forms of it? He was a noble man, in whom was mingled to the last much of the delightful nature of the boy. Few, very few, could be named who combined so much sweetness with so much light.'

Most of Rolleston's research and writing was henceforth directly connected with his Professorship. The subjects he had to deal with may be best described by quoting from the Obituary notice of the Royal Society, of which he was elected Fellow in 1862, written by his friend Professor W. H. Flower:—'The duties of the Linacre Professorship involved the teaching of a wide range of subjects included under the terms of physiology and anatomy, human and comparative, to which he added the hitherto neglected but important subject of anthropology, as well as the care of a great and ever-growing museum. In the present condition of scientific knowledge it requires a man of very versatile intellect and extensive powers of reading to maintain anything like an adequate acquaintance with the current literature of any one of these subjects, much more to undertake original observations on his own account. Even a man of Rolleston's powers felt the impossibility of any one person doing justice to the Chair as thus constituted, and strongly urged the necessity of dividing it into three professorships, one of physiology, one of comparative anatomy, and one of human anatomy and anthropology. The work which he did however contrive to find time to publish, and by which he will be chiefly known to posterity, is remarkable for its thoroughness. He never committed himself to

writing without having completely mastered everything that had been previously written upon the subject, and his memoirs bristle with quotations from, and references to, authors of all ages and all nations. The abundance with which these were supplied by his wonderful memory, and the readiness with which, both in speaking and writing, his thoughts clothed themselves with appropriate words, sometimes made it difficult for ordinary minds to follow the train of his argument through long and voluminous sentences, often made up of parenthesis within parenthesis. The work which was most especially the outcome of his professorial duties is the "Forms of Animal Life," published at the Clarendon Press in 1870. Though written chiefly with a view to the needs of the University students, it is capable of application to more general purposes, and is one of the earliest and most complete examples of instruction by the study of a series of types, now becoming so general. As he says in the preface, "The distinctive character of the book consists in its attempting so to combine the concrete facts of zootomy with the outlines of systematic classification, as to enable the student to put them for himself into their natural relations of foundation and superstructure. The foundation may be wider, and the superstructure may have its outlines not only filled up, but even considerably altered by subsequent and more extensive labours; but the mutual relations of the one as foundation and the other as superstructure which this book particularly aims at illustrating, must always remain the same." Rolleston's desire that his professorship should be divided into more manageable departments was not fulfilled in his lifetime, but the University has since partly carried out his recommendations, his field of work being now occupied by the Linacre Professor of Human and Comparative Anatomy (Professor Moseley), the Waynflete Professor of Physiology (Professor Burdon-Sanderson), and the Reader in Anthropology (Dr. E. B. Tylor). One of the latest tasks which Rolleston took up, the pressure of which indeed shortened his life, was to embody the new and ever-growing results of comparative anatomy in a fresh edition of his

own book. Though he did not live to complete this undertaking, it has not been neglected; his plans are being carried out by his former pupil and demonstrator Mr. W. Hatchett Jackson, who looks to completing the work in its new form in 1885, and who in the meantime has contributed several characteristic touches to the present memoir.

Of Rolleston's style as a medical writer, no more characteristic specimen can be seen than the Harveian Oration which he was called upon by the College of Physicians to deliver in 1873. Combining anatomist and scholar as he did, he was able to make this, not a mere panegyric or medical thesis, but a contribution to scientific history, elucidating for the first time various points in the great discoverer's career, and his relation to contemporaries and rivals. This oration, which attracted great attention among the Faculty, is here reprinted (Art. xli), and in its latter pages the non-professional reader will be interested to find stated Harvey's position as the real demonstrator of the circulation, working by methods so new that he sometimes not unreasonably feared he should set all men against him. The examination of contemporary records made by Rolleston for this purpose has added also to our biographical knowledge of Harvey, whose college life and philosophical thought have much of that diffused interest which genius throws beyond the limits of its actual path.

Wide as was the main work of Rolleston's life, it was not in his character to keep within its limits. Where discursive thought led him into adjacent subjects, he would follow the track; and this he did on principle, holding that his mind was the better for its many-sidedness. Indeed he had a stock formula to express contempt for a man who was only classical or only scientific—'Stupid fool, he can only do one thing.' Though he doubtless lost much force by thus expending himself in too many directions, there must be set against this his gain by making one thing bear on another. Talking once to his present biographer of the way in which he found his anatomy and classics and antiquarian research converge on the study of man, he illus-

trated his experience by a story he had heard of a famous row in the Dublin Theatre. 'A man in the gallery had got another in his arms and was in the act of pitching him over, when a voice from below was heard to cry, 'Don't waste the man, kill a fiddler wid him.' 'So I never throw away a fact,' the Professor moralised, 'it is sure to have its use somewhere.' One practical good gained by many-sided sympathies and tastes was in the effect he had in stimulating those who came to see him at the Museum; they would go away with new interests implanted in them, and often, especially when they were stationed or travelling in distant countries, they would do useful scientific work. All over the world he had friends eagerly collecting specimens for him. His sympathy with missionaries stood him in good stead in this way, and much friendly intercourse arose, as for instance with Mr. Whitmee the missionary and philologist, who became acquainted with him through a specimen of the *Didunculus strigirostris*, the nearest living relative of the Dodo, and which now inhabits the same case with the skeleton of that famous bird.

In the line of Anthropology, his chief publication was his part of Greenwell and Rolleston's 'British Barrows[1].' The two friends had spent many delightful days on the Yorkshire wolds, searching the burial-mounds of ancient chiefs on the wild moors and ferny hill-sides where they have as yet escaped destruction at the hands of the ditcher and the ploughman. Canon Greenwell devoted himself especially to the archæological objects found, and Dr. Rolleston to the human remains. He considered the collection of skulls figured in the volume to confirm the easily remembered rule that the long barrows of the stone age were the graves of a long-skulled people then dwelling in the land. In burial-mounds of later times, generally round, remains of men of both narrow and wide type of skull

[1] British Barrows: a Record of the Examination of Sepulchral Mounds in various parts of England, by William Greenwell, M.A., F.S.A.; together with Description of Figures of Skulls, General Remarks on Prehistoric Crania, and an Appendix, by George Rolleston, M.D., F.R.S. Oxford (Clarendon Press), 1877.

are found, as if the new broad-skulled people had not exterminated but mingled with their narrow-skulled predecessors. By what national names these races ought to be called is a question only answerable as yet in the vaguest way, and indeed not likely ever to be fully answered. But it will always have an attraction for historians and anthropologists, who will find it treated largely and soberly by Rolleston. The early skull-type of the long barrows he connects with the black-haired type still prevalent in the West of England, shorter in stature, feebler in development, and with a narrower skull than the men of the fair tint of skin and hair. To the old narrow-headed population he inclines to give the name Silurian, after the well-known passage of Tacitus (Agr. 11) about the natives of Britain. He protests against the name Iberian, now often used with the implication that an early population of Britain came across from Spain. Such a name should not, he considered, be given without definite reasons, and he points his protest by a quotation from Professor Rhys that the tradition of an old connexion between Ireland and Spain may be nothing but an etymological myth founded on the similarity of the names *Iberus* and *Hibernus*. To the broad-skulled type of men who come in with the round burial-mounds he gives the name Cimbric, from likeness of skull between these bronze-using Britons and the Danes whose country was once known as the Cimbric peninsula. Among the less technical parts of the volume are studies of the civilisation of the ancient races of Britain. While the earliest known of these, the men of the palæolithic period contemporaries of the mammoths, lived in England when its hills and plains had not yet their present contour, the later neolithic men whose remains are found in the long barrows belong to a time when the outline of the country had come much into its present shape, for their forts and burial-mounds stand on high places of view and vantage which show that their land already had its escarpments and river-courses much as at this day. These stone-age tribes of Britain were inferior to the stone-age lake-dwellers of Switzerland, whose communication with the Mediterranean

nations had given them corn, unknown to our early hunters and fishers. It is pointed out how the honey of the rude ancients was got at first from the wild bees, till the device was hit upon of imitating the hollow trees where they built, by making artificial structures of bark to house them in. These earliest hives keep a record of their former use in the French word *ruche*, from Latin *rusca*, 'bark,' though it is now many ages since they were superseded by hives of basket-work.

One of Rolleston's favourite objects of contemplation on his frequent journeys as he watched the varying landscape was the change brought about by man since the ages before history; how different the trees are from those the old Silurians looked upon, especially how the hedgerows are now marked by lines of elms which, though rarely seeding in this climate, have propagated themselves by suckers since Roman times. He worked this subject out in one of the Glasgow science lectures and in a paper read before the Geographical Society in 1879 (here reprinted, vol. ii. p. 769). Readers who follow the problem of tracing the periods at which our country was stocked with its domestic animals, or are interested in the serious practical harm which reckless cutting down of forests has done to the climates of such countries as Egypt, Greece, and India, will find it well worth while to peruse the multifarious information in this lecture. And though the addresses of presidents of sections of the British Association are apt to be forgotten when they have answered their temporary purpose, Rolleston's, of which several are printed in the present volumes, will still yield ideas. If there was one place more than another where he was in his element, it was at the British Association. It was not merely that like plenty of other speakers he had something informing to say on many subjects – he had the power of making his words send out as it were intellectual waves, succeeding one another till he had brought his whole audience into sympathetic vibration. When he presided, his powerful presence made him really master of the situation. A letter to the 'Times,' written by his friend Prebendary Buckle, gives no unfair idea of his excellence in this

capacity, as seen at the sub-section of Anthropology at Bristol in 1875: 'he had contrived to gather round his presidential chair some of the leading men in literary as well as in physical science, and those who had the good fortune to be present will not easily forget the intellectual tournament, which from day to day filled the room to the very doorways and riveted the interest of the audience, and in which he held the scales and adjusted the palm with the skill and authority of an acknowledged master . . . Among the many fields in which Professor Rolleston will be sorely missed, the arena of the British Association will not be the least.' His Address at this meeting (p. 880) took up several anthropological topics of wide interest. Bagehot had remarked, and Darwin quoted his remark, that 'savages did not formerly waste away before the classical nations as they do now before modern civilised nations; had they done so the old moralists would have mused over the event; but there is no lament in any writer of the period over the perishing barbarians.' Rolleston had been struck at the first reading with the beauty and originality of this passage, but on second thoughts he asked himself whether it was safe to argue that there were no perishing barbarians from the silence of the classical writers about them, any more than it would be safe to say that Stonehenge was not standing because the Romans did not mention it. The conclusion of this address shows how thoroughly the speaker took the study of Anthropology to be the study of Human Progress, and how the pessimistic doctrine that the world is going more and more to the bad, a theory just then beginning to hold up its head anew in Europe, seemed to him irreconcileable with the facts. A good example of his fresh way of dealing even with well-worn topics is to be found in his paper on the Iron, Bronze, and Stone Ages (p. 660). One would hardly have expected to find such a subject treated with new lights in the Transactions of a local Archæological Society, but it is plain that the writer having undertaken to read a paper, as his manner was, put his whole force into it. No one had shown so clearly that the effect on civilisation ordinarily attributed to

the use of iron belonged rather to the introduction of steel, as the old hunters and warriors had little motive to give up their bronze weapons for soft iron ones not practically superior to them. Both from this point of view, and in looking to Central Asia rather than to Britain or the Far East as the earliest source of bronze, this paper is of mark. Some interesting points as to the succession of iron, bronze, and stone weapons are raised by Dr. Rolleston in unpublished letters to his friend Mr. John Evans. In one he remarks on Professor Schaaffhausen's assertion that in some of the Mithra sculptures on the Rhine the bull is being slain, not with the ordinary ornamented metal sword, but with what appears to be a stone hatchet. This clearly proved (which however it does not seem to have been) would be an interesting case of keeping up an ancient weapon for ceremonial purposes, as in the parallel case of the flint (silex saxum) with which the Roman pontifex slew the sacrificial ox. The same line is followed in another letter commenting on a heavy sword of one piece of bronze, with a bull-dog's head for the pommel of the hilt, in the Museum of Nismes. This, if a war-sword taken from a foe, would interfere with his opinion that 'there is no evidence to show that the Romans ever crossed their own Iron swords in anger with Bronze ones in the hands of any enemy.' But if it was a sacrificial sword, then 'during the Bronze period, Bronze must be supposed to have displaced the Silex Saxum in Ritual, and to have retained its place there, when superseded by iron in other activities.'

To turn from Rolleston's scientific work to the part he took in University affairs, his colleagues on Delegacies and on the Hebdomadal Council remember the brilliant oratory with which he often enlivened their debates. His friend the President of Corpus Christi College, who had sat with him at many meetings, thus sketches him in this public capacity: 'The qualities which struck one in Rolleston were the directness of his language, his fearlessness, and his withering contempt for anything he regarded as mean, or cowardly, or finessing. He had a genuine hatred for compromises, which sometimes perhaps made him unnecessarily hard on the proposals of others; but the presence of such an

element always added force and elevated the tone of any assembly of which he was a member.' Among the measures which he took up strongly was the affiliation to the University of Oxford of colleges intended, like University College, Bristol, to supply local needs. Another proposal which he took part in deserves notice from its intrinsic importance, notwithstanding that it was not carried out. This was that students passing an Examination in the Final School of Natural Science, turning mainly on their proficiency in the branches of science taken up, should receive Degrees in Natural Science, and not in Arts. This proposal was carried in the Hebdomadal Council, but was eventually rejected by Congregation. The objections to the proposed change came partly from those to whom the innovation seemed in itself undesirable, but also partly from those on the scientific side who thought that the recognised stamp of the B.A. degree had more practical value than a B.Sc. degree unfamiliar to the public. As the question of the desirability of conferring Science degrees as is done by the University of London will doubtless arise again at Oxford, it is well to mention Dr. Rolleston's position in the matter. His views on the general subject of Examinations were strongly felt and not less strongly expressed, tested as they had been by years of comparison between a man's class and his merits as judged by the world in after life. No one was more sensible of the use of examinations within limits. Answering an enquiry made by the friends of one of his students, he writes, 'He has been working steadily, but from one cause or another he has not put the results of his work so clearly before me as I could wish. More than once or twice he has been ill at the end of Terms, and left me without the evidence which a terminal Examination, an excellent institution, furnishes us.' It is interesting, however, to notice a certain change in his opinions in the course of experience. In 1863, toward the beginning of his professorial work, he writes to his brother in New Zealand a carefully-considered letter on education, in which he remarks, 'That frequent examinations are an evil to the very best men I admit, but it is only to the very best

men, who are a very small class, and all human regulations inconvenience somebody; good men are benefited by being obliged to take stock of their attainments, and put them into easily manageable form and shape; bad men, φαῦλοι mentally and morally, are saved often from utter ruin by the consciousness that a sword of Damocles is hanging over them, "jamjam lapsura cadentique imminet assimilis," in the shape of a coming examination.' But the longer he taught, the more he became impressed with the harm done to a serious student's career by the pressure to get up subjects in order to answer questions. He tells a favourite and successful pupil that he hopes to get him an appointment 'when you have got rid of these examinations.' Referring to a case where some men were put in a lower class than they were known to have merited he says, 'Such accidents in the very nature of the case will from time to time occur and teach everybody to look to other results besides those of Class Lists.' His desire to alter the Examination system in Oxford increased with years, and one of his last occupations was to set down the results of his experience in a Memorandum. Here he fully acknowledges the value of Examination. The awakening of intellectual activity by its institution at the beginning of the century cannot, he says, be doubted by any one acquainted with the previous condition of Oxford. But Examination has been accepted 'both inside and outside the University as an Institution for imposing Mint Marks and Trade Marks on men who pass through it as First, Second, Third, and Fourth Class-men. I believe (with the Scotch University Commissioners) that this function does more harm than good, and I hold that the Universities ought to be content to divide men into two Classes only, those two to be one Class in alphabetical order of Honour-men, and another, also in alphabetical order, of Pass-men.' More men, he believes, would be encouraged to work for the object of getting above the Pass-man level than are found now to work for the hope of getting one of three or four Classes. But to his mind the strongest argument lies in the notorious misplacements in classing. He draws up a list to show 'a few of the glaring

instances in which a man whose talents and even genius had been found by the world at large to be far superior not merely to those of the average First Class-man, but to those of mankind generally, has been placed in a Second or Third Class in an Oxford Examination, and so far as such a verdict could go, stamped with a badge of inferiority, or a false mint mark. Of course thereby more or less injury was done to the man himself, and the public were more or less deceived.' From Genoa, Jan. 13, 1881, he writes to Professor Max Müller:—'I have sent off an extract from a memorandum of mine against our Examination system. The more I think of it, the surer I am that with our system of gambling and cramming for classes we shall never succeed in making the pursuit of knowledge a real end in the University. The largest fact I know about it is that the Scotch Universities Commission, with our plan of a trifid or tetrafid Class List before them, deliberately recommend that there should be only two divisions allowed, viz. Class-men and Pass-men. I wish you would think of it, and if you agree with the view that a multiplicity of Classes I, II, III, and IV intensifies the gambling element, and also produces more cases of injustice and injury than the other plan of one Honour Class and one Pass, do ventilate the plan.' Then follow names of men whose later careers had conspicuously reversed the verdict of the Examiners, including (what is not to be found in the more public Memorandum) a little list of First Class-men whom the world has not thought much of afterwards. How charged Rolleston's mind was with this subject is seen by his following this letter by another, written within a month, from Bordighiera:—'I hear that the University Commission is likely to ask for another year wherein to finish their work, and I suppose therefore, though I am not very sanguine, that we have some more hope of getting them on to lines with a somewhat broader gauge than they are upon at present. The reform of all others which is the most important is the reform of the Examination system. It really rules everything almost which Oxford has in the way of activity; by virtue of its gambling element it possesses an attractiveness

which no other purer rewards or pursuits can have. 'I see from my window Monaco with its Prince, its Jesuits and their schools, its nunneries, and its mediæval castle lately underpinned and plastered up; and under it the modern Monte Carlo with its modern appliances of all kinds and its gambling Casino, and I feel that this latter place represents the Examination system with its excitement, its gambling, its power to dull aspiration of every better kind, and its all but entire monopoly of the activity of the place, albeit the blind Prince does walk about with one priest in front and another behind him, and has everybody pushed out of the way as he passes.'

Though Dr. Rolleston had ceased to practise as a physician, his experience in past days of the life and sufferings of the poor was deeply imprinted in his mind. The sanitary work and improvement of labourers' dwellings which has come to the front as a duty of these modern days, was one chief business of his Oxford life. Showy philanthropy he had no liking for, and he would speak his mind about it plainly enough. Talking of some modern hospitals where much power for healing had been sacrificed for external decoration, he would say—'In such a place the Physician will fondly lead about My Lord Bishop of This and My Lord of That, and show them with much pride an interesting eruption on the hand of a delicate girl, surrounded with every conceivable comfort. *I* would take them to a house in the slums and show them a boy blown up with dropsy after scarlet fever—no nurse—children sprawling on the floor, and mother up to the elbows in soap-suds washing for her family, who are sickening of the disease and soon to be fresh centres of it—the father out of work or perhaps in gaol. These are the people one wants to help before spending money on Gothic buildings.' It was with these practical ends in view that he sat for years on the Oxford Local Board, working at drainage, water-supply, and sanitary regulation. The difficulty of inducing the classes who suffered most from unhealthy homes and exposure to contagion of course met him at every step. He used often to recall one of his experiences at the time of the

Small Pox epidemic in 1871. A poor woman whom he had engaged as laundress in the Small Pox Hospital refused to be re-vaccinated. 'I almost went down on my knees to entreat her,' he said. 'No, she had a drunken husband, her family depended on her work, she could not afford to lie idle if her arm should become swollen and incapacitated after vaccination. So she had her way, caught small-pox, and died.' He used to say that he felt he had the guilt of that woman's death on his soul, for not having insisted on her being re-vaccinated. This outbreak of small-pox in Oxford engaged him in some of his hottest public controversies. News reached him on a journey abroad that some members of the Local Board thought it unnecessary to furnish and occupy the Small Pox Hospital which had been built outside the city on the Woodstock Road. He hurried home to press forward energetic measures to protect life by setting up field-tents and resorting to strict isolation of cases and other sanitary precautions. He used to work in visiting the sick and convalescent, keeping a coat for such visits, that he might not bring home infection. It was at this time that, in answer to his demands for instant action, some one replied that the disease was at present only among the children of the poor. The torrent of rebuke which Rolleston poured on him is not forgotten to this day. Scenes so exciting as this did not often happen, but, as is usual on such Boards, there was many a rough encounter. One of his demonstrators describes him coming home about 5 o'clock one afternoon after a stormy meeting. 'He came into my room and said, "After this meeting I shall take a walk round the Parks. I feel tired." "I thought you enjoyed meetings," said I. "So I do," he replied, "and there was a rampage to-day, and where a rampage is (pointing to himself), there is *he*." I laughed, and he said, "Yes, I know what you are laughing at—you think where *he* is, there is a rampage—and you are about right."' Notwithstanding, he began to feel after a while that this strife was wearing him, and taking his time from his classes at the Museum, and he gave up the Local Board.

It seems to have been in 1867 that Rolleston first took a

public part in the Temperance movement, at a meeting of the National League held in the Oxford Town Hall. In 1868 he became a Vice-President of the United Kingdom Alliance, and threw his force into the line of the Permissive Bill, in support of which he argued—'If I look out of my window, I see no public-house at every corner of my strip of garden, but I know that many a poor man sees that temptation constantly before him, and many a poor wife as constantly sees that temptation at the bottom of the alley she lives in. I claim for the poor man the same right which Providence has enabled me to purchase for myself.' He felt so strongly that nine-tenths of the misery and vice of England was 'attributable to drink and nothing else,' that at a Temperance Meeting in his own parish of Holywell in 1880, the last meeting he ever went to, when questioned about compensation to publicans he went so far as to answer, 'that if several persons suffered through the ill effects of one man's trade, it was hardly reasonable to expect that compensation would be offered to the few who caused much suffering to fall on the many.' As to the hygienic question of intoxicating liquors, he approved of abstinence on medical grounds, a favourite example being the wonderful power and endurance he had witnessed among the poorer Turks, 'too poor for drunkenness.' Always a most temperate man himself, he became eventually a total abstainer. His medical reputation gave weight to his speeches, which may be found reported in the Temperance journals, and especially noticed in the sketch of him by Mr. S. Insull.

Among the various letters written by Dr. Rolleston to the 'Times' is one of Sept. 18, 1879, where, on his return from a tour in Scandinavia, he gives the result of his examination of the 'Gothenburg system,' under which the Municipality itself carries on the public-houses. The letter is too long to insert as a whole, but the following extract is a good example of Rolleston's argumentative humour :—'The information which I obtained in Gothenburg prevents me from denying that since 1876, the year in which the Gothenburg system came into full operation by the final disappearance of the outstanding independent licences,

"drunkenness has decreased wonderfully;" and my informant, whose words I quote, but who, like myself, has seen reason to disbelieve wholly in the "system," professed himself astonished at the change. You may think that my informant and myself are hard to please if we do not think this a success. I have to say that a man must be hard to please and must not be easily satisfied nor contented with first impressions if he is either to get at the real facts or to draw true inferences from them in a matter which is not merely somewhat complex in itself, but which touches hardly on the one side upon powerful pecuniary, and on the other upon powerful philanthropic interests. The first rule, however, in Natural History and, I imagine, in all other sound investigation, is to make yourself acquainted with all the circumstances of the case, and in stating your problem, at least to yourself, to omit from consideration no condition which may in any way be relevant to the question of causation. This rule is a little elementary, but it is also a good deal neglected. Acting upon it, I will remark that the three years in question which have seen the Gothenburg system in full operation, besides being but three years, a sufficiently short time to base even a B.A. degree upon, have been years of severe commercial distress in Gothenburg as in England, with which country the bulk of its trade is carried on. Now we are not here and now so far removed from the memories of the cotton famine as to have forgotten that certain evils, such as that of excessive infant mortality, to say nothing of drunkenness, diminished greatly in England during that period. But nobody ascribed the diminution of that mortality to any other cause than the very obvious *vera ac sufficiens causa*, which shut up the mills and left the mothers to stay at home and look after their children. And I cannot see why the same line of reasoning may not be applied to the case of Gothenburg, with its three last years of hardship. The analogy is mine, the explanation it suggests to your readers was the one given me by my informant; they can judge for themselves which of the two antecedents has been the more or the really operative one. But Descartes' rule as to an exhaustive

dénombrement of all the circumstances of your case admits of, or rather calls for, more than one additional application in this investigation. When we come to deal with statistics of drunkenness we come to deal in reality with statistics of police-courts, and therein with a set of exceedingly deceptive and not altogether pleasant "personal equations." Now, it has been observed by competent observers, that if part of the fine inflicted after conviction for drunkenness be awarded to the functionary who has brought such offenders to justice, such arrests are more frequent (in Sweden) than they are under a *régime* which trusts simply to that innate loathing for drunkenness and aversion to disorder which make up the ideal of the genuine policeman. But of late in Gothenburg, as I was informed, the former plan, with its appeals to self-interest, has been laid aside; and a form of night and day blindness, undescribed by oculists, has, as I was also informed, been observed to have fallen upon members of the force. It is right, however, to add that previously those functionaries may have been a little too Draconian in their arrests; and I was told of sailors, and especially of English sailors, who were arrested on charges of drunkenness on no better evidence than that of a hilarity little exceeding that which a Bishop sometimes shows in an after-dinner speech, and of an unsteadiness of gait which the accused avowed was but their ordinary nautical walk.'

Rolleston's advocacy of the Permissive Bill brought him in several ways into contact with practical politics. When Bruce's Act for the early closing of public-houses came into operation it caused much excitement among the publicans, and led to some rioting and smashing the windows of prominent teetotalers. The hostility of the liquor trade to the Liberal Party had much to do with the opposition to Sir W. Vernon-Harcourt's re-election when he vacated his seat on being made Home Secretary in 1880. At any rate Mr. Hall, who then ousted him, was an influential local brewer, and the *Daily News* attributed the reversal of the former election to 'pot-boy politics,' so that a fair inference may be made as to the motives of Professor

Rolleston and his friend Professor T. H. Green, who were mainly instrumental in obtaining a Parliamentary Commission to enquire into Corrupt Practices in the City of Oxford. This Commission had especially to deal with a class of voters who had brought disgrace on the constituency, which the enquiry resulted in depriving up to the present time of both its Members, by the suspension of the Parliamentary Writ.

In 1872, when it was proposed to establish a Military Centre at Oxford, Professor Rolleston, anticipating from the scheme an increase of distraction and dissipation of student life, took a prominent part in the action of Convocation against it. The Vice-Chancellor was authorised to sign a memorial, and a Delegacy of six persons (of whom Dr. Rolleston was one) was appointed for the purpose of having an interview with the Secretary for War. This opposition, as well as the private influence which Rolleston exerted himself to bring to bear on Members of Parliament, was unavailing, as was another attempt in 1874. That the University should have opposed the establishment of barracks at Oxford is intelligible, but the apprehension proved quite unfounded that undergraduate life would be made more luxurious, or indeed perceptibly affected at all, by the military element.

On a larger matter of politics, Rolleston acted with greater effect, led by the conviction of the hopelessness of Turkish rule, derived (as has been already pointed out) from his Crimean experiences. He mentions this himself in a letter written from Lausanne, Oct. 7, 1877, to Baron de Bogushevski, thanking him for some Slavonic skulls and insisting on their entire distinctness from German skulls. 'I hope you may have noticed that I have been engaged in several Anti-Turk societies in the way of subscribing &c. I was one of the conveners of the St. James's Hall Meeting last autumn, which I rejoiced to see yesterday the official newspaper at Constantinople observed had shown them they would not get help from us. I wish you or any of your countrymen, who must find it hard to understand how the English can sympathise with those wretched Turks, could have seen that

meeting in that large hall. It was mainly of educated and more or less reserved men, but they showed an enthusiasm equal to that which a mob might have shown. If Gladstone had only known what he knows now when he was in the plenitude of his power, I believe we should have abolished the vile rule of the Osmanlis some years ago. However, I believe you will do it by yourselves, though we of the really Liberal way of thinking should have been glad to have done our share in company with you. Every day I am expecting to hear you have smashed up one or both of the armies of the savages you are fighting against.'

Both as Professor of Physiology and as a Member of the Medical Council, Dr. Rolleston felt called on to take a leading part in the question of vivisection, or, to put it more accurately, experimentation on living animals. As early as 1863, at the British Association at Newcastle, he had taken up the subject in his Presidential Address to the Biological Section; and in 1871, when presiding over the same Section at Liverpool, he drafted the resolutions of a Conference which led to legislative action. When the Royal Commission was appointed in 1875, he was of course called to give evidence. He stated it as his opinion that for teaching purposes before large classes some few experiments may be useful and expedient, provided invariably that the animal be rendered insensible by anæsthetics and killed before returning to sensibility; it may thus be practically considered as dead, although for physiological purposes it is a living machine. He did not wish to prevent experiments on animals for *bona fide* scientific purposes, but if causing pain they should not be performed before more than an exceedingly limited number. However, he thought such experimentation very liable to abuse, as likely to tempt a man into carelessness of the sight of suffering, and specially as acting on the emotional nature in a way which he compared to the effect on the spectators of the ancient gladiatorial shows. Considering that the practice required to be specially guarded, he recommended that a register should be kept of all experiments, and that they should only be performed in authorised places open to an inspector. This was the gist of

Dr. Rolleston's recommendations, and he also entered into details of the gradual increase of sensibility in the public mind as to the infliction of pain and death, for which those interested should consult the Parliamentary Report itself. Indeed any who for serious purposes desire to examine the conflict of opinion on this subject, will do well to follow it rather in original documents, such as this Blue-Book, than in passages selected for controversial ends. His own conclusion is briefly expressed in a letter where he says, 'A good many scientific men are in the same position as I am. We think restrictions are called for, whilst total abolition is not.' The Vivisection Act of 1876 now in force, and which arose out of the Parliamentary Report, was highly satisfactory to him, as may be judged by the following passage from a letter written at the time: 'I am greatly delighted with Mr. Forster, who has made the Government accept an amendment, which I in my smaller sphere had made the Medical Council accept, whereby frogs are not to be left to the tender mercies of every would-be experimentor. The passing of this Cruelty to Animals Bill is a great step in the history of mankind. There is no country except England and the United States where it could have been passed.' Rolleston's part in this legislation was, however, far greater than is here suggested. Indeed it is obvious to any one who compares the extremely stringent provisions of the Act with the minutes of Dr. Rolleston's evidence, that the new law was in great measure framed on his recommendations, which it follows implicitly.

Such is a brief inventory of work done by Rolleston in his twenty years of professorial life. He did not keep a regular record of the events and interests which diversified his course of labour, and such mentions mostly come up incidentally in letters. Midway in his Oxford career he escaped 'from daily toil and fret' by a return to the East in 1871. He had all the delight of the classically-bred Englishman in steaming round Cape Malea into the Egean, and testing the outlines of the hollow Spartan shore by the well-remembered epithets of Homer and Theokritos. He found the wood-covered hills of Smyrna as he had left them,

and renewed some of his old friendships. He saw Athens, which he had failed to visit in former years, and was angry that historians should have said Greek history was on a small scale, 'as if men were to be counted like pheasants at a battue.' All the classic in him comes out in a characteristic estimate of the surroundings of Athens, 'as much superior to those surrounding most English writers as Aristotle is to ——' (naming a well-known Oxford metaphysician). It was eight years before he made another distant journey, when in 1879 he went with General Pitt-Rivers to Sweden. He was much struck with the manliness of Scandinavian life, the absence of the worst side of poverty, the provisions for public enjoyment, the behaviour of the upper classes contrasting advantageously with England, and the active influence of the Court for good. The object of their visit was to see Museums and Universities, and they were impressed, not indeed with any of these excelling what might be seen at home, so much as by the educational activity among a nation so much less in number and wealth than Great Britain. In a letter written next year to General Pitt-Rivers, Dr. Rolleston comments on 'this cheeseparing Government.' 'I should be in despair if it were not for what we saw done by people of the same flesh and blood as ourselves, but much poorer and less aristocratic, last summer. Recollect what sums are spent, and, as the enclosed cutting from the "Times" of yesterday shows, are going on being spent by democratic Scandinavians for Science.' Among the letters written to General Pitt-Rivers is one of earlier date, taking up the question how far it was well for the Anthropological Institute, when making an effort to increase public knowledge on the then popular subject of Turkey, to go into politics. 'It seems to me that it is well to avoid bringing science into collision or into connexion with moral, social, or political issues more than is inevitable. I always envy mathematicians who have nothing to do with these questions. Of course if you cannot avoid it, you must face it like other disagreeable necessities; but then it is a very difficult thing to balance moral and scientific reasons against each other. In this case I don't see

any necessity for the Institute taking the matter up. It seems to me an entirely political one . . . .' The extremely important subject, at what stage in the development of science its results may be wisely brought into contact and it may be conflict with political and social opinions, is thus in Rolleston's view to be managed by keeping science and practice apart as long as may be. Whether he was right or wrong, his judgment must be fairly stated and considered, as based on experience. Here, as elsewhere, the writer of these memorial pages feels it no office of his to discuss the positions taken up by Rolleston in science, politics, or religion. His task is only to survey these positions —of their strong and weak points the reader will judge.

It remains to speak briefly of Rolleston's last year of life. Though not even past middle age, he had for years felt the strain of life growing more and more severe. Renal disease set up by excessive toil had morbidly increased his nervous excitability, when the work he still craved for became yet more harmful. The physicians urged him to rest, but this was the very thing he could not do. For instance, during his last Term at Oxford, he rose every morning at six to get two hours free for revising his 'Forms of Animal Life' before the ordinary hard day's work began. Such pressure could not last, and he had to yield to medical advice, and leave England to spend the winter 1880–1 on the shores of the Mediterranean. He went out with Sir William Gull and Dr. Acland to Florence in December, joining his sister, Miss Margaret Rolleston, who was already abroad and could give him the attention he needed for the few months which his family confidently hoped would restore him to health, while Mrs. Rolleston was kept at home by the care of their young children. His starting on this his last journey was sad, for, seeing the future more clearly than those nearest him, he no longer carried with him the expectation of coming back with new vigour to the battle of life. An old pupil came to him at the Museum, and found him very ill but thoughtful as ever for his friends. He said, 'Now is there anything more I can do for you? I shan't be here long to do anything for any-

body. There's that testimonial I have written for you, and I've put your name down at the Athenæum.' The present writer saw him in London just starting, full of his old interests, and far less troubled for himself than for his unfinished work. In the hot bright climate of the Riviera his strength revived, and his old capacity for enjoying nature showed itself still strong in him. He went to Nice, and there with Mr. Alfred Tylor examined the human jawbone lately found imbedded in the hill-side, apparently in remote prehistoric times. The description written by him of this jaw was his last scientific paper[1]. A few days later he moved to Bordighiera, whence he wrote home to his family a description of the hills clothed with olives to their tops, and the oranges and lemons and 'real date-palms' below. On his way with Mr. George Macdonald to visit Mr. Thomas Hanbury at La Mortola, he pleased himself in picturing how different an aspect the landscape would have presented to the prehistoric man he had lately been describing—only the hills and pines the same, the now characteristic fruit-trees of the region not yet come from Asia. The tropical vegetation of the gardens of La Mortola raised in his mind a glow of pleasure, expressed in another home letter. A few weeks later, having gone on to Corsica, he writes to one of his sons that he had there found a young General in the Mexican service who could neither read nor write, but who had

[1] At Prof. Turner's suggestion, the following extract is taken from this memorandum, which is too unfinished for printing *in extenso*. 'These bones . . . were found in digging the cellar of a little country house about a mile out of Nice, about 10 feet down in a deposit of river sand mixed with calcareous matter, in which fresh-water snail shells were found. The bones had been thrown out in spadesful of the deposit, but Mons. Joachim [the proprietor] was clear that they had formed an intrinsic part of the deposit itself. Now this deposit is far above the level of any stream in that locality at present, and it is above the level of terraces very like those now made by the proprietors in this district for olives: and due, like the similar ones at Amiens, to the action of a quaternary pluvial period. So it must have been much older than they, and indeed deposited before the river had become as small and the valley as large by a very great deal as it is now.' The lower jaw in question is very imperfect, the angle is strongly marked for the masseter muscle, mentum feeble, alveolar part of front relatively long, sockets for incisors small; there are 3 molars and 1 pre-molar, very little worn, and Dr. Rolleston judged the jaw to have belonged to a woman nearer 18 than 24.

got him a fox's skin and skeleton, and appeared on the whole less of a savage than most of his fellow-islanders. These are trifling details, but they make up the picture of a man still able to hold his own against bodily weakness, still comforted by friendship, and spreading around him the social enjoyment so well remembered by his friends. A graver letter from Corsica shows him under the influence of rest and quiet contemplation among the paradise-vegetation of the island, not yet burnt up by the summer sun, with the sea and the snow-mountains dividing the distant landscape. Here he had come to feel, for the first time in many years, that labour should have its bounds; he quotes George Macdonald's lines:—

> 'Help me to yield my will in labour even,
> Nor toil on toil, greedy of doing, heap,
> Fretting I cannot more than me is given.'

He goes on to view his experience of Oxford, in the 'transition from one system to another, from that of Protection of things sacred by artificial enactment, with the usual result of neglect of duty and ignorance, to that of free exposure to open competition in the battle with the unrestrained spirit of modern thought.' The correspondent he is answering had evidently put to him some searching theological questions, to which he replies: 'It is true that as regards many doctrines, I should, as in the case of the particular one you dwell upon, be slow either to assert myself in definite words, or to condemn other persons for having some one or for not having some one definite set of phrases about any such tenets. Many doctrines are really beyond the power of the human understanding to grasp, and I cannot see my way to making them *de fide* either for myself or for others. Or to put the matter still more in the concrete, whilst I am on the one hand a member of the Association for the Reform without Disestablishment of the Church of England, I am on the other one of some seven or eight Professors of Science who were to meet at Lambeth to confer privately with the Archbishop last Christmas on the supposed incompatibility of Belief and Science. So, I think, you have the facts as to my

position with reference to the very serious issues of which you write.' Nothing could show more clearly that in these last weeks of his life his mind lay in a cheerful calm. He was of those, to be accounted happy in death, who do not in their last hours painfully shift the moorings they have made fast to in time of health and strength. The temporary revival to which this letter belongs was not to last. On his way back to England increased illness prostrated him, and it was with difficulty that his friends Dr. Child and Mr. Chapman, who went to meet him in Paris, were able to bring him home to Oxford, where his bodily distress, borne with a gentleness and patience which impressed the physicians who watched him, came to its end on June 16, 1881, in his 52nd year.

Dr. Rolleston's face and bearing are well recalled by the portrait in this volume. His picture by Miller hangs in the Common Room of Pembroke College, with an inscription below by his friend Professor Goldwin Smith:—

'Sic indefessum facie spirante vigorem
Veri enitebar mente aperire viam
Cum vitæ et vultus nimio lux victa labore est
Et vestræ abrepta est gloria magna domo.'

A yet more striking memorial is the bust of him by Pinker, presented to the University Museum by Mr. Henry Willett of Brighton, and now placed in the spot which was the centre of his working life, and where for time to come new students will become familiar with the lines of a countenance never to be mistaken for any other man's.

LIST OF THE PUBLISHED WRITINGS OF PROFESSOR GEORGE ROLLESTON, M.D., F.R.S.

ARRANGED IN CHRONOLOGICAL ORDER.

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1. [1856]. Report on Smyrna, prepared at the request of the Right Honourable the Secretary of State for War. (London: Queen's Printers, 1856: pp. 1–123.) [This Report contains a geographical description of Smyrna; an account of its political history, of its population, the languages spoken there, its climate with medical notes, and its commerce.]

2. [1861]. On the Homologies of the Lobes of the Liver in Mammalia. (*British Association Reports*, 1861: Part II. pp. 174, 175.) Article IX, p. 72.

3. [1861]. On the Anatomy of Pteropus. (*British Association Reports*, 1861: Part II. p. 173. Title only.)

4. [1861]. On some Points in the Anatomy of Insectivora. (Short abstract in *British Association Reports*: Part II. pp. 173, 174.) [The abstract states that Dr. Rolleston gave a number of details as to the osteological, digestive, circulatory, generative, and nervous systems of the Insectivora, dwelling especially upon the instances of variability of organs, not subservient to special habits, and upon the variations in individuals belonging to the same species.]

5. [1861]. On the Affinities of the Brain of the Orang-Utang. (*Natural History Review*, 1861: pp. 201–217.) Article I, p. 3.

6. [1861]. On the Correlations of Growth, with a special example from the Anatomy of a Porpoise. (*Natural History Review*, 1861: pp. 484–488.) Article IV, p. 56.

7. [1862]. On the Affinities and Differences between the Brain of Man and the Brains of Certain Animals. A Lecture delivered at the Royal Institution, January 24, 1862. (*Medical Times and Gazette*, 22 Feb.–15 March, 1862.) Article II, p. 24.

8. [1862]. On Certain Modifications in the Structure of Diving Animals. (Abstract in the *British Association Reports*, 1862: Part II. pp. 118–119.) Article V, p. 62.

9. [1862]. Sugar as Food and as a Product of the Body. A Review. (*British and Foreign Medico-Chirurgical Review*, 1862.) [A Review of a number of recent works on the importance of sugar as food, on its normal production in the body, and on its excessive production in diabetes.]

10. [1862]. On the Difference of Behaviour exhibited by Inuline and ordinary Starch when treated with Salivary Diastase and other converting Agents. (*British Association Reports*, 1862: Part II. p. 135.) Article XXVII, p. 498.

11. [1863]. Notes on the Post-mortem Examination of a Man supposed to have been a hundred and six years old. (*British and Foreign Medico-Chirurgical Review*, XXXI. 1863: pp. 505–513.) Article XII, p. 141.

11*a*. [1863]. Address on Physiology to British Association at Newcastle. (*Reports*, p. 109, 1864.)

12. [1864]. Von Baer on Papuans and Alfourous and the Origin of Species. (*The Reader*, 9 January, 1864.) [A Review of Von Baer's well-known Essay.]

13. [1866]. On the Placental Structures of the Tenrec (*Centetes ecaudatus*), and those of certain other Mammalia; with remarks on the value of the Placental System of Classification (1863). (*Zoological Society's Transactions*, V. 1866: pp. 285-316.) Article X, p. 74. Also in Abstract in *British Association Reports*, 1863, p. 122.

14. [1866]. Sewage and Sewerage. A Review. (*Quarterly Journal of Science*, III. April, 1866: pp. 180–199.) [In this Article the author discusses 'how we are to dispose of our sewage without either spoiling our rivers, or robbing our fields, or poisoning ourselves.']

15. [1867]. Note on the Blood Corpuscles of the Two-toed Sloth (*Cholopus didactylus*) and of the Elephant (*Elephas Indicus*). (*Quarterly Journal of Microscopical Science*, VII. 1867: pp. 127–130.) Article VII, p. 68.

16. [1868]. On the Domestic Cats (*Felis domesticus* and *Mustela foina*) of Ancient and Modern Times. (*Journal of Anatomy and Physiology*, II. 1868: pp. 47–61.) Article XXVIII, p. 501.

17. [1868]. On the Cat of the Ancient Greeks. (*Journal of Anatomy and Physiology*, II. 1868: pp. 437–438.) Article XXIX, p. 515.

18. [1868]. Physiology in Relation to Medicine in Modern Times. An Address delivered at the Meeting of the British Medical Association at Oxford, 5 August, 1868. (Published in the *Lancet*, 8 August, 1868, p. 176; the *Medical Times and Gazette*, 15 August, 1868, p. 184; and in 'Medicine in Modern Times,' pp. 49–102, London, 1869.) Article XL, p. 693.

19. [1868]. On the Pectorales Muscles. (*British Association Reports*, 1868, p. 120, Title only; and *Medical Times and Gazette*, 1868, Vol. II, p. 274.) [This communication is incorporated in Article XI, p. 112.]

20. [1868]. On the Physiology of Pain. (*British Association Reports*, 1868, p. 120, Title only; and abstract in *Medical Times and Gazette*, 1868, Vol. II, p. 250.) [Reasons were given for thinking that shock as well as vaso-motor disturbance could cause pain, and that counter irritation, especially of the fifth nerve, was valuable as a preventive or anæsthetic agent.]

21. [1868]. On Sixteen Eskimo Crania. (*British Association Reports*, 1868, p. 120, Title only; and abstract in *Medical Times and Gazette*, 1868, Vol. II, p. 274.) [A number of general propositions were stated with reference to this series of Crania; some of which were referable to the special habits of the people, others to their tribal or ethnological peculiarities.]

22. [1868]. The Fallacy of Reference. (A Letter to the *Lancet*, 19 September, 1868: p. 395.) [This letter was written to show how unsafe it is to take any assertion as to a third writer at second hand.]

23. [1868]. Hints on House Construction. (A Letter to the *Lancet*, 21 November, 1868: p. 681.) [This letter was written

to recommend that in building a house a layer of impervious material should be spread over the entire area on which the house is to be built, and not confined to the so-called 'damp course' which is put into the walls. Also that the small-calibred drain pipes should be surrounded by a layer of gravel, so as to dry a water-logged soil.]

24. [1868]. On the Modes of Sepulture observable in late Romano-British and early Anglo-Saxon Times in this Country. (*Transactions of the International Congress of Prehistoric Archaeology*, Third Session, 1868: pp. 176–184.) [This paper is mainly based upon investigations conducted in a cemetery at Frilford in Berkshire. Dr. Rolleston subsequently published in the *Archæologia* detailed accounts of these investigations, which are reprinted in Articles XXXIV and XXXV.]

25. [1869]. The Earth Closet System. (*Lancet*, 6 March, 1869: p. 319.) Article XLVII, p. 923.

26. [1869]. The Dry Earth System. (A Letter to the *Lancet*, 20 March, 1869: p. 411.) [This letter was written in reply to one by the Rev. Henry Moule, the introducer of the dry-earth system for the disposal of sewage. Dr. Rolleston advocates a water system as preferable to a dry-earth system, and points out what he regards as the dangers of the latter.]

27. [1869]. On the various Forms of so-called 'Celtic' Cranium. (*Journal of Anatomy and Physiology*, III. 1869: pp. 252–255.) Article XIII, p. 155.

28. [1870]. On the Character and Influence of the Anglo-Saxon Conquest of England, as illustrated by Archaeological Research. (*Proceedings of the Royal Institution*, Vol. VI, p. 116; reprinted in *Nature*, Vol. I, p. 661.) Article XXXVIII, p. 681.

29. [1870]. The Relative Value of Classical and Scientific Training. A Review. (*Nature*, 1870, Vol. II, pp. 250–252.) Article XLVI, p. 916.

30. [1870]. Biological Training and Studies. Address to the Biological Section of the British Association, Liverpool. (*British Association Reports*, XL. 1870: pp. 91–109.) Article XLIII, p. 846.

31. [1870]. Forms of Animal Life, being Outlines of Zoological Classification, based upon anatomical investigation and illustrated by descriptions of specimens and of figures. 8vo. pp. 436. (Clarendon Press, Oxford, 1870.)

32. [1870]. On the Homologies of certain Muscles connected with the Shoulder Joint (1868). (*Linnean Society Transactions*, XXVI. 1870: pp. 609–630.) Article XI, p. 110.

33. [1870]. On Trophic Nerves. A Review. (*Quarterly Journal of Science*, VII. 1870: pp. 200–206.) [In this Article the author directs attention to a series of facts which appear to him to demonstrate that there are trophic and secretory nerves to act on pigmentary, secretory and other cells, as well as vaso-motor nerves to act upon contractile cells.]

34. [1870]. Researches and Excavations carried on at an Ancient Cemetery at Frilford near Abingdon in the years 1867 and 1868. (*Archæologia*, 1870: Vol. XLII, pp. 417–485.) Article XXXIV, p. 581.

35. [1871]. Reasons for appointing a Medical Inspector to hold office during the carrying out of our Drainage Scheme. Addressed to the Members of the Oxford Local Board. (Oxford, 1871: pp. 1–13.) [A print of a speech delivered 15 November, 1871, in support of a motion made by Dr. Rolleston that it was expedient to appoint an Officer of Health during the carrying out of the Drainage works.]

36. [1871]. On Typhoid or Enteric Fever in Indian Gaols, and on the Relations of that Disease and of Cholera to the Dry-earth System of Conservancy. (*Lancet*, January 7, p. 7, and 14, p. 42.) Article XLVIII, p. 927.

37. [1871]. The Propagation of Cholera. (A Letter to the *Lancet*, September 2, 1871, p. 339.) [This letter was written to show that whilst cholera is and may be propagated by drinking water, yet that water is not the sole channel of its propagation.]

38. [1871]. On the Development of the Enamel in the Teeth of Mammals, as illustrated by the various stages of growth demonstrable in the evolution of the fourth molar of a young Elephant (*Elephas indicus*), and of the incisor teeth of the

fœtal Calf (*Bos taurus*). (*Transactions of the Odontological Society* of Great Britain, 1871, Vol. III, p. 239; and reprinted in the *Quarterly Journal of Microscopical Science*, XII. 1872, pp. 109–111.) Article VI, p. 65.

39. [1872]. On the Skulls obtained in Canon Greenwell's Excavations. (*British Association Reports*, XLII. 1872: pp. 193–194.) These skulls are fully described in Articles XV, XVI, reprinted on pp. 163, 223.

40. [1872]. On the Weddo of Ceylon. (Abstract in *British Association Reports*, XLII. 1872: p. 194.) Article XIV, p. 161.

41. [1873]. Harveian Oration, 1873. (London: Macmillan & Co.) Article XLI, p. 729.

42. [1874]. Address on the Examination System, delivered at the Distribution of Prizes in the St. Mary's Hospital Medical School, London, May 7, 1874. Article XLV, p. 907.

43. [1874]. In Memoriam John Phillips, M.A., F.R.S. (*Proceedings of the Ashmolean Society*, Oxford, May 15, 1874: pp. 1–7.)

44. [1875]. Address on Anthropology to the Anthropological Department of the British Association, Bristol. (*British Association Reports*, XLV. 1875, p. 142; *Nature*, 1875, XII. pp. 382–386.) Article XLIV, p. 880.

45. [1875]. On the Applicability of Historical Evidence to Ethnographical Inquiries. (*British Association Reports*, 1875: p. 178. Title only.)

46. [1875]. Letter in *Archives de Zoologie Expérimentale*, Vol. IV, 1875, Notes et Revue, p. 111. [In this letter Professor Rolleston vindicated Mr. E. Ray Lankester's claim to priority over M. Fol relative to the discovery of the origin of the endoderm in the Mollusca by budding from the nutritive cells of the yelk, and other points in the development of the Mollusca.]

47. [1875]. On the People of the Long-Barrow Period. (*Journal of the Anthropological Institute*, Vol. V: pp. 120–172. Plates IV, V, VI. Read 13 April, 1875.) Article XVIII, p. 353.

48. [1876]. On the Domestic Pig of Prehistoric Times in Britain, and on the mutual Relations of this variety of Pig and *Sus scrofa ferus*, *Sus cristatus*, *Sus andamanensis*, and *Sus barbatus*. (*Linnean Society Transactions*, Second Series, Zoology, Vol. I, 1876; also under title, 'On the Prehistoric British *Sus*,' in abstract in *Journal of Linnean Society*, Zoology, XIII. p. 108.) Article XXX, p. 518.

49. [1877]. Notes on the Animal Remains found at Cissbury. (*Journal of the Anthropological Institute*, Vol. VI: pp. 20–36. Plate XIX. Paper read 23 November, 1875, and publication delayed.) Article XIX, p. 409.

50. [1877]. Description of Figures of Skulls obtained in British Barrows. ('British Barrows,' by Canon Greenwell, pp. 559–623. Clarendon Press, Oxford, 1877.) Article XV, p. 163.

51. [1877]. General Remarks upon the preceding Series of Prehistoric Crania. ('British Barrows,' by Canon Greenwell, pp. 627–718.) Article XVI, p. 223.

52. [1877]. On the Prehistoric Flora of this Country in the Neolithic Period, being an Appendix to the Account of the Crania obtained in British Barrows. ('British Barrows,' by Canon Greenwell, pp. 720–725.) Article XVII, p. 321.

53. [1877]. On the Prehistoric Fauna of Neolithic Times, being an Appendix to the Account of the Skulls obtained in British Barrows. ('British Barrows,' by Canon Greenwell, pp. 725–750.) Article XVII, p. 321.

54. [1877]. On the Flora and Fauna of Prehistoric Times. (Abstract in *British Association Reports*, XLVII, 1877: pp. 120–121.) [This paper is incorporated in the Appendix to the Crania described in British Barrows, Article XVII, p. 321.]

55. [1877]. On the Rationale of Brachycephaly and Dolichocephaly. (*The same.* Title only.) [This communication is incorporated in the General Remarks on the Series of Prehistoric Crania; Article XVI, p. 264.]

56. [1877]. On the Rationale of Artificial Deformations of the Head. (*The same.* Title only.)

57. [1877]. New Points in the Zoology of New Guinea. (Abstract in *British Association Reports*, 1877, XLVII. pp. 102–103; *Nature*, 1877, p. 409.) Article XXXI, p. 565.

58. [1878]. The Blood Corpuscles of the Annelides. (*Journal of Anatomy and Physiology*, XII. April, 1878: p. 401.) Article XXVI, p. 480.

59. [1878]. Three Anatomical Notes and two Anatomical Queries. (*Journal of Anatomy and Physiology*, XIII. October, 1878: p. 115.) Article VIII, p. 71.

60. [1878]. On the three Periods known as the Iron, the Bronze, and the Stone Ages. (*Transactions of the Bristol and Gloucestershire Archæological Society*, 1878.) Article XXXVI, p. 660.

61. [1878]. Report of Excavation of a Twin Barrow and a single Round Barrow at Sigwell, Somerset. (*Journal of the Anthropological Institute*, VIII. 1878: pp. 185–191.) Article XXI, p. 440.

62. [1879]. Notes on a Skeleton found at Cissbury, April, 1878. (*Journal of the Anthropological Institute*, VIII. May, 1879: pp. 377–389.) Article XX, p. 428.

63. [1879]. Note on the preservation of Encephala by the Zinc Chloride. *Journal of Anatomy and Physiology*, XIII. Jan. 1879: pp. 232–233.) Article III, p. 53.

64. [1879]. Description of a Human Skeleton found in a Barrow at Rockley. (*Wiltshire Archaeological Society*, August, 1879.) Article XXII, p. 453.

65. [1879]. The Changes produced by Man in the Indigenous Fauna and Flora of Great Britain. (*Glasgow Science Lectures Association*, Jan. 9, 1879: pp. 1–16.) [The substance of this Lecture is included in Article XLII.]

66. [1879]. Further Researches in an Anglo-Saxon Cemetery at Frilford, with Remarks on the Northern Limit of Anglo-Saxon Cremation in England. (*Archæologia*, 1879, XLV: pp. 405–410.) Article XXXV, p. 653.

67. [1880]. The Modifications of the External Aspects of Organic Nature produced by Man's interference. Lecture at Evening Meeting of the Royal Geographical Society, May 12, 1879. (*Journal of the Royal Geographical Society*, 1880, XLIX: pp. 320–392.) Article XLII, p. 769.

68. [1880]. Jade Tools in Switzerland. (Letter to *The Times*, January 2, 1880.) Article XXXIX, p. 686.

69. [1880]. Crayfish: an Introduction to the Study of Zoology. [A Review of Professor Huxley's well-known book.] (*The Times*, May 24, 1880.)

70. [1880]. Report on the Fauna of a Crannog at Lochlee, Tarbolton, Ayrshire. (*Proceedings of Society of Antiquaries of Scotland*, XIII. 1880: pp. 241–245.) Article XXIII, p. 456.

71. [1880]. Report on Bones from Chastleton. (*Journal of Anthropological Institute*, X. August, 1880: pp. 126–127.) Article XXIV, p. 460.

72. [1880]. On the Double Malar Bone. (*British Association Reports*, 1880, L: p. 604. Title only.) [This paper is probably incorporated in the Report on Bushmen Crania; Article XXV, p. 462.]

73. [1880]. On the Classification of Rodents. (*The same.* Title only.)

74. [1880]. On the Structure of Round and of Long Barrows. (*The same*: p. 623. Title only. *Nature*, XXII: p. 478.) Article XXXVII, p. 679.

75. [1880]. On Bushmen Crania. (*The same*: p. 631. Title only.) [Incorporated in Article XXV, p. 462.]

76. [1880]. On the Rot in Sheep. (*The Times*, April 14, 1880, and reprint in *Zoologische Anzeiger*, Jahrg. III. p. 258, 1880.) Article XXXII, p. 567.

77. [1881]. Note on the Geographical Distribution of *Limax agrestis*, *Arion hortensis*, and *Fasciola hepatica*. (*Zoologische Anzeiger*, Jahrg. III. p. 400, 1880; *Journal of the Royal Agricultural Society of England*, XVII. S. S. 1881, Part I.) Article XXXIII, p. 571.

78. [1881]. Report on Bushmen Crania in 'Matabele Land and the Victoria Falls: a Naturalist's Wanderings in the Interior of South Africa. From the Letters and Journals of the late Frank Oates, F.R.G.S. Edited by C. G. Oates, B.A.' (London, 1881.) Article XXV, p. 462.

In conjunction with Charles Robertson, Esq.

79. [1861]. On the Aquiferous and Oviducal System in the Lamellibranchiate Mollusks. (*Transactions of the Royal Society*, London, 1861.) [The authors conducted a series of experiments made in the way of injection, in which they attempt to prove that the orifices on either side of the foot in the Unionidae lead both to the generative gland, the products of which may be seen to issue forth from them at the spawning-season, and to a system of tubes widely spread through the entire foot. They do not believe that any direct communication subsists either between the blood vascular system and this system of tubes, or between either of these systems and the punctated depressions and inlets along the foot edge. The blood vessels seem to constitute a system of tubes closed, save at one point and at one lacuna. That point and that lacuna is the pericardial space—a cavity into which, besides the blood of the animal, the water in which it lives also finds its way. As the bivalve shell opens the lacuna is dilated and the water is drawn into it through the organ of Bojanus. The water then passes into the interior of the blood vessels, from which they believe it to transude into the system of water-tubes everywhere in apposition with them and under normal conditions to find its exit by these tubes, whilst under such abnormal circumstances as the sudden removal of the animal from the water, the sudden contraction of the muscular foot causing jets of water to pour forth from the dilated semitransparent mass, may unload the infiltrated organ in a yet more expeditious manner.]

HITHERTO UNPUBLISHED[1].

Notes on the site of Roman Pottery Works at the Mynchery, upon the Sewage Farm near Oxford. Page 937.

Notes on Archæological Discoveries at Wytham, Berkshire. Page 939.

Notes on Archæological Discoveries at Yarnton, Oxfordshire. Page 942.

[1] These notes form an Appendix to the second volume.

ANATOMY

AND

PHYSIOLOGY.

I.

ON THE AFFINITIES OF THE BRAIN OF THE ORANG UTANG.

As an opportunity has quite lately been afforded me of dissecting an Orang Utang, and as the University Museum possesses a considerable number of preparations which illustrate the 'Zoological Relations of Man with the Lower Animals,' it is less presumptuous in me than it otherwise would have been to write upon a subject which has met with such able, as well as such recent handling in the Natural History Review[1]. The great attention which the paper to which I allude has attracted, renders it unnecessary for me either to recapitulate the views it propounds, or to specify in detail the points in which I agree, or those in which I feel myself compelled to differ, with the writer of it, whose authority I should be little likely needlessly to dispute.

In this paper it will be with human rather than with simious brains that I shall contrast and compare the brain of the Orang Utang; incidentally, however, I shall institute comparisons between the brain of the Asiatic ape, and that of the smaller of the two most anthropoid African apes, the Chimpanzee.

Tiedemann and Buffon exemplify, respectively, the two most opposite views which it is possible to entertain as to the question of the actual anatomical truth, on the one hand, and of the possible anthropological bearings of the former of these two comparisons, on the other. Buffon, writing in 1766, speaks of the brain of the orang in much the same language as Tyson, in his 'Anatomy of a Pygmie,' had, more than sixty years previously, applied to the brain of the chimpanzee. Between these brains and that of man

[1] 'On the Zoological Relations of Man with the Lower Animals.' By Professor Huxley, 1861.

there was, according to these writers, actually no difference at all. 'Le cerveau est absolument de la même forme et de la même proportion[1].' And the doctrine of the immateriality of the soul was, in the estimation of these authors, not merely compatible with, but a corollary of these not wholly correct anatomical premises. Though the brain in each is the same—in the one the power of thought exists, in the other it is absent. Thought, therefore, cannot be a product of the material organism. 'Il ne pense pas—y-a-t'il une preuve plus évidente que la matière seule, quoique parfaitement organisée, ne peut produire, ni la pensée, ni la parole qui en est la signe, à moins qu'elle ne soit animée par un principe supérieur?'

The modern idealist may avoid his predecessors' anatomical errors, but if he be true to his principles, he will feel no anxiety to repudiate their metaphysics. He may make his strong position yet stronger, we believe, by adducing biological evidence in disproof of the usually granted assumption, that mental capacity stands always in a certain relation to cerebral development; but holding, as he does, the existence of an essential difference between mind and matter, he makes himself but a materialist for the nonce, if he express any repugnance to such statements as those just quoted on account of any conclusions to which they could lead *him*. For even if they were wholly, as we believe they are nearly, true to the facts, he could draw from them, if he remained true to his principles, no other conclusions than did Buffon and Tyson.

Reasoners of the kind to which we allude will do well to imitate the logical consistency of the materialistic author of the 'Icones Cerebri Simiarum.' Tiedemann, at all events, had no half-hearted faith in his creed. He plights his faith to the scalpel and callipers, and betrays no anxiety as to any possible upsetting of his conclusion by such data as consciousness or the history of psychical phenomena could furnish. 'Parvus ergo encephalus orang-utangi rationem physicam et certam prodit, uti jam celeberrimus Soemmerring monuit, cur animi facultatibus tantopere ab homine distet. In homine praevalere cerebrum, summumque hominis bonum, rationis usum, ab ipsa maxima encephali evolutione pendere, haud dubitari potest. Praecipua et essentialis ergo differentia, quae ipsum hominem et reliqua animantia intercedit, in cerebro posita est[2].'

[1] 'Histoire Naturelle,' tom. xiv. p. 61, Paris, 1766.

[2] 'Icones,' Cor. xxxii. p. 55.

Having indicated our opinion that the dealing with such views as those just quoted from Tiedemann's thirty-second corollary is to be safely, though by no means of necessity, delegated to the metaphysician, we may proceed forthwith to lay before the reader the anatomical details which will enable him to decide for himself, whether the Heidelberg anatomist or the French natural historian was the nearer the truth in the matter of fact.

Multitudinous as are the differences which a detailed comparison of any two brains will disclose, they yet admit of being arranged under four heads. Under the first of these heads we may class those differences which the observant anatomical eye would detect without the assistance of any anatomical instrument, and could express without being necessitated to employ any technical anatomical knowledge.

Our second class of differences comprehend such as the scales and the callipers reveal.

For the powers of describing, and one might almost say, for the powers of discovering the third class of differences, we are indebted to M. Gratiolet's masterly analysis of the cerebral convolutions. Previously to the appearance of the 'Mémoire sur les Plis Cérébraux de l'Homme et des Primates,' it was all but impossible to express in words the differences which the eye detected in the arrangement in two different brains of what has been called 'the chaos of the convolutions.' What was previously all but an impossibility, M. Gratiolet's philosophy has made an easy task. No apology can be necessary for adopting his phraseology, as the right of naming the country he has conquered is a prerogative never denied to one who has succeeding in subduing a territory which few before him had ever thought of invading.

Under our fourth head we shall arrange those points of difference which a dissection of the brain alone can reveal.

These four heads correspond, it is obvious, to the successive stages of an anatomical investigation; and they possess, consequently, the merit not merely of colligating conveniently the results, but also of corresponding accurately to the several processes of an accurate anatomical investigation.

The orang dissected was a young male (*Simia Morio*). The first two molars had just come into use in both jaws; the weight of the entire body was 16 lbs. 12 oz.; the height was 2 ft. 7 in. None of the

internal viscera presented any appearance of disease. The lungs, which were both but unilobar, were crepitant throughout, free from congestion, collapse, or tubercle.

The callosities on the backs of the fingers, which have been held, and with some show of probability, to indicate the existence of a state of debility, were absent.

The roof of the cranium was removed by a circular incision, intersecting the foramen magnum posteriorly. Before the removal of the dura mater the cerebral hemispheres were seen to cover the superior surface of the cerebellum entirely, and even to project a very little way beyond it posteriorly. After the removal of the dura mater a small segment of cerebellar surface became visible on each side, posteriorly to the tips of the occipital lobes. It is well known[1] that the antero-posterior dimensions of the corpus callosum are very different in a brain whilst contained and supported within its case, and when removed from the skull—the forward swaying of the hemispheres upon their supporting stems, the crura, flattening the previously arched commissure. That it was the weight of the hemispheres, working similarly, which produced the alteration just noted in the relations of the cerebrum to the cerebellum was seen thus—*a wider segment of cerebellar surface was visible on the left side than on the right, the animal lying over towards its right side.*

The greater width of the semi-lunar segment exposed on the left side was no doubt owing to the gravitation of the cerebral lobes, but the greatest width of this segment was only three lines. The relations thus described are well shown in Pl. iii. Fig. 3. The view of the base of the brain, as given in Fig. 2, will enable us to complete our observations as to the relations of the cerebellum to the posterior lobes of the cerebrum. On looking at that figure it will be seen that no cerebral surface comes into view on the outside of the lateral boundaries of the cerebellum. In a view of the base of the human brain, some cerebral substance is invariably seen in this situation; but the same is the case with a second orang's brain, with a chimpanzee's brain, and with the brains of several *Cercopitheci*, and an *Inuus*, in the series belonging to the Christ Church Museum.

[1] 'Bei der Messung der Lange des Balkens muss man wohl im Auge behalten dass man ihn misst so lange die Hemisphären ihre Lage noch in Schädel haben; am heraus genommenen Gehirn dehnt er sich sehr beträchtlich in die Lange aus und verliert seine Wolbung.' Huschke, 'Schädel, Hirn und Seele,' p. 110.

The cerebellum does not prôject so far laterally as to cover the cerebral lobes in a basal view of any brain in Tiedemann's 'Icones' which is above the rank of the *Lemuridae*. Two figures[1] of the brain of the gibbon given by M. Sandifort, which present a relation of the cerebral lobes to the cerebellum, much resembling that which I have described in the brain of the first of the two orangs in our Museum, M. Gratiolet regards with suspicion, whilst he himself records the existence[2] of a similar relation of the two parts of the encephalon in the gorilla. M. Gratiolet gives the figure of the brain of the chimpanzee as drawn by Tyson, only to express a strong opinion as to its worthlessness; and as he condemns it, as well as the two figures of M. Sandifort, on grounds quite independent of the view they give of the cerebellum and its relations, we may perhaps be justified in disregarding any evidence which might be based upon these three figures, and in considering the condition and relation of the parts in the subject of this paper as an individual, rather than a specific, peculiarity.

The roof-like exterior of the skull of the gorilla would prepare us for meeting with quite another relation of cerebellum and cerebrum than that which we find in the sub-globular skulls of the smaller anthropoid apes. For though the transverse diameter in these latter skulls taken from one parietal protuberance, or rather from one spot homologous with such protuberance to the other, is only sub-equal to the transverse diameter as taken from the one supra-mastoid region to the other, it is yet never markedly inferior, as is the case with the gorilla, to a degree for which no development of mastoid air-cells can account.

The evidence then for the lateral predominance of the cerebellar lobes rests upon the single instance, the subject of this paper, and upon the three representations which M. Gratiolet sees, upon other grounds, good cause for condemning. Against it is to be set the evidence based upon the examination of several other simious brains as above specified, upon the unanimous assent of every one of the plates given by M. Gratiolet in his 'Mémoire sur les Plis Cérébraux,' and upon Tiedemann's figures of the brains of the *Simia rhesus*, *Simia nemestrina*, *Simia sabæus*, and *Cebus capucinus*. If the weight of this latter mass of evidence is not sufficient to make us

[1] Gratiolet, 'Mémoire sur les Plis Cérébraux,' Planche iv. fig. 1 and 2.

[2] 'Comptes rendus,' Avril 1, 1860, p. 803.

consider the relations of the parts as seen in our specimen, Fig. 2, as mere individual peculiarities, it is at all events sufficient to justify us in denying them, not merely all classificatory, but also all physiological value.

For arrogating importance to any projection or predominance backward of the cerebellum, still less justification exists. For so doing no other colour can be brought forward than such as our own figures can afford, for which we have adduced a sufficient explanation, or such as certain confessedly imperfect figures[1], taken as they were from a confessedly badly preserved brain, may be thought to furnish, when weighed against the all but unanimous verdict to the contrary which is obtained by the examination of authentic representations and of well-preserved specimens. In every specimen, save the single one the subject of this paper, of a simious brain above the grade of a lemur, contained in our Museum, the cerebellum is as much covered posteriorly by the cerebral lobes as we have already shown it to be laterally. The same remarks apply to every one of M. Gratiolet's own figures; the only exceptions to the rule which his plates offer being those which the imperfect figures of Tyson and Sandifort furnish. Tiedemann's Icones of the lower apes are unanimous on the same side, but the figures which he gives of the brains of the orang and chimpanzee, in his work on the Brain of the Negro[2], represent the cerebellum uncovered, on both sides, to a somewhat greater extent than it is in our own figures 3 and 4, on one side[3].

A careful study, however, of our figures, coupled with an examination of the skulls of several anthropoid apes, will lead to the

[1] Schröder Van der Kolk et Vrolik, citt. Gratiolet, 'Mem.' 49, Planche vi. 5 and 6.

[2] Citt. ap. Wagner's 'Icones Zootomicæ,' Taf. viii. figs. 2 and 3.

[3] Since the above paragraphs were written, casts have been taken of the interior of the skulls of our second orang and of the chimpanzee, with the following results. The cast of the orang's skull approximates more nearly to the proportions of the brain we have figured than does the prepared brain it represents; the relative extent of the space occupied by the mass corresponding to the cerebellum being somewhat greater than that occupied by the cerebellum itself, in the specimen. Still, in such a view of the cast as that given in fig. 3 of the first of our brains, no cerebellar surface at all comes into view; though a little less cerebral surface comes out laterally than in the preserved brain in a similar view to that in fig. 2. The cast of the chimpanzee's skull represents the cerebral hemispheres as overlapping the cerebellum to a greater extent posteriorly than they do in the preparation, the hemispheres having in this, as in certain figured preparations, fallen apart laterally somewhat, and lost thus in antero-posterior what they have gained in lateral extent.

belief that the cerebral hemispheres of the apes bulge less laterally than do those of man; that they are not merely more boat-shaped, and tapering anteriorly and posteriorly, but that they are more wall-sided, and less protuberant laterally.

Though we may be inclined to consider the diminution in lateral expanse, and in backward growth of the posterior lobes, D, of which our figures speak, as an individual rather than as a specific peculiarity, we are impelled to assign greater importance to the curtailment in downward growth to which they, as well as other similar figures, testify. A line drawn along the edge of the cerebral hemisphere in Fig. 1, where that hemisphere overlies the cerebellum, will be seen to be much less clearly horizontal than a line is, which holds the same relation in a human brain. It seems as if the cerebellum had encroached upon the cerebral lobes which roofed it over.

The same figure shows that a similar stunting has befallen the upward growth of both the frontal and posterior lobes, a line bounding the superior edge of the hemispheres from D forwards to A, describing a much more even curve than is usual in man.

Less ambiguously does the vertical direction of the fissure of Sylvius F, and of the convolution, 6, 6, 6′, parallel with and immediately below the lower lip, 7, 7, 7, of that fissure, speak of diminished relative antero-posterior growth of the frontal lobes. The greater relative thickness of the nerves is well seen in Fig. 2.

These nine points of greater or less discrepancy between the human and the simious brain may be arranged under our first head; they consist, in the ape, of diminution in downward, lateral, upward and antero-posterior growth, first, of the posterior, secondly, of the frontal lobes; and to these, based on consideration of diminution, we have to add the ninth, based upon a consideration of increase, that, viz. of the size of the nerves. What is the value of these points as differentiating characteristics? Two canons may be laid down to assist us in estimating the value of such characteristics as means for settling the relative rank of rival organisms. The first of these may be thus expressed:—If certain structures, or certain relations of certain structures, are found to exist in animals confessedly lower in the scale of life than those which are the subjects of comparison, the presence of such structures, or of such relations of structures, cannot *by itself* be held to be a

mark of serial elevation. Cumulatively, it may have weight; absolutely, it can have none. The second canon is but a converse of the first; and expressed in similar language, it may run thus:—If certain structures, or certain relations of certain structures, are found to exist in animals confessedly higher in the scale of life than those which are the subjects of comparison, such structures, or such relations of such structures, cannot by *themselves* be held to be marks of serial degradation. Cumulatively, they may be of weight; absolutely, they are not. These canons have been, perhaps necessarily, expressed in complex language; in themselves, however, they are sufficiently simple and self-evident, and being so, are compatible with either view of the origin of species.

The first of these canons we have already applied, in our comparison of the overlapped cerebellum of the lower monkeys with the partially unoverlapped cerebellum of our orang. The even curve described by the boundary line of the superior surfaces of the Bush-woman's brain, as given by M. Gratiolet in the first plate appended to his often-quoted work, and the anteriorly and posteriorly tapering ends of the hemispheres there figured, enable us to apply the second canon to the several marks of degradation spoken of, as diminution of upward and of lateral growth in the frontal and the occipital lobes. The even, regular curve[1] indeed of the skull, and its narrowing, tapering frontal and occipital regions, as seen in the lower races, would have led us to anticipate some such cerebral conformation as the unhappily all but unique specimen of such a brain as the one just referred to actually discloses to us.

The foramina for the nerves in the skulls of the lower races of mankind have been said by certain ethnologists[2] to present larger diameters than the similar foramina in the basis of the skull of higher races; and if this be really the case, our first canon will come to apply to our ninth point of difference, the larger relative sizes, namely, of the nerves in the simious brain.

The three points of diminution in downward development of the posterior lobes, and in both downward and in antero-posterior de-

[1] 'Hunterian Osteological Catalogue,' 5346, 5755. See, also, 'Symbolik der Menschlichen Gestalt,' von C. G. Carus, p. 170, fig. 34.

[2] Prichard, 'Phys. History,' vol. i. pp. 294, 296, 302; Lawrence in description of Negro skull; and 'Phil. Trans.' 1836, p. 517, which I had not seen when I wrote this. But Tiedemann, citt. Prichard, 'Phys. Hist.' ii. 352, says the nerves of the Negro are not larger relatively to his brain than those of Europeans.

velopment of the frontal, remain unaffected by the application of either canon. Of their value our figures will enable the reader to judge for himself.

After comparing our single brain of the chimpanzee with the two of the orang we possess in our Museum, we cannot see that the African ape contrasts in any one of these nine points to disadvantage with the Asiatic.

Under our second head,—that, namely, of the differences which weighing and measuring enable us to enucleate as existing between the several subjects of our comparison,—we have eight points of difference to enumerate. When it is not otherwise specified, the measurements of the human brain were taken from a brain of a German of average intelligence, the brain having recently been brought to the Museum, and presenting nothing peculiar, in the way either of under- or of over-development, to render it unfit to serve as a standard of comparison to the brain of the orang. Both sets of measurement were taken at the same time.

The entire weight of the orang's body being 16 lb. 12 oz., the weight of the brain was 12 oz. The relation of the weight of the brain to that of the body was, therefore, as 1 : 22·3.

I find recorded by Huschke[1] a set of observations analogous to these. They were made upon a child of six years of age. The child was a girl, dying emaciated of pleuro-bronchitis.

Weight of body.....	13,377 grammes, or c^a. 29 lb.
Weight of brain.....	1,215 grammes, or c^a. 2 lb. 10 oz.
The brain : the body = 1 : 11.	

The state of emaciation in which this child is reported to have died makes it the fairer to take it as a standard in this comparison. The child's dentition may very well have been in the same state as that of our orang; its age, however, was in all likelihood much further advanced; but as the brain would have been growing rapidly during those years, whilst the weight of the body was not increased proportionally, the excess of years may not in reality have caused in this case any diminution in the relative disproportion of the child's brain to its body, as it does in cases of healthy development.

[1] 'Schädel, Hirn und Seele,' 1854, p. 112; 'Phil. Trans.' 1836, p. 501. Boy, æt. 3, Body well nourished = 41 lb. 2 oz. Troy: Brain = 2 lb. 3 oz. 2 dwt. 28 gr. Ro = Body, 18·008 : 1 Brain. Girl, æt. 8·8, Body well fed = 49 lb. 2 dwt. 51 gr.: Brain = 3 lb. 5 oz. 5 dwt. Ro = Body, 14½ : 1 Brain.

On the other hand, we must recollect that the proportion subsisting between the adult brain in man and the body has been put as low as 1 : 50[1]; and that though this proportion is lower by as much as 15 than most authorities would rate it, some such disproportion must have prevailed in those cases in which the brain of an adult Negro is recorded as reaching no greater weight than 753 grammes[2], or 1 lb. 10·59 oz.

The weight of the body of a nearly adult female chimpanzee is given by Professors Sharpey and Ellis, on the authority of Professor Owen, as 61 lb. The relation of weight between such a body and the brain of our orang, which weighed 12 oz., would be 1 : 81·3[3].

Let us suppose that the Negro, the weight of whose brain, as given by Tiedemann, amounted to no more than 26 oz., weighed altogether as much as 8 stone, or 1792 oz. The proportion between his brain's weight and his body's would then have stood as 1 : 68·9, as against a proportion taken between analogous weights in the apes of 1 : 8·13. It will be seen from this that the absolute weight of the human brain is a more sharply differentiating characteristic than is its relative weight.

It will be convenient to give the following measurements and their mutual relations in a tabular form, using, for the sake of economy of space, the letters of the alphabet to denote each particular measurement:—

a. The length from the root of the olfactory nerve to the anterior extremity of the brain.

b. The length from the point of the middle lobe to the posterior extremity of the brain.

c. The length of the cerebellum.

d. The breadth of the cerebellum.

e. Length of cerebral hemispheres.

f. Length of the corpus callosum.

a : b.	In Orang	= 1¾ inch. : 2⅞ inch.	= 1 : 1·64.
	In Man	= 2⅝ inch. : 5¼ inch.	= 1 : 1·95.
	In Chimpanzee[4]	= 44 mm. : 69 mm.	= 1 : 1·56.

[1] Huschke, l. c., p. 60.

[2] Tiedemann, citt. Huschke, p. 73.

[3] 'Quain's Anatomy,' by Sharpey and Ellis, vol. ii. p. 433, note, 1856.

[4] Schrœder Van der Kolk et Vrolik, citt. 'Nat. Hist. Review,' No. 1, p. 80.

c : d.
- In Orang = 1¼ inch. : 3 inch. = 1 : 2·40.
- In Man = 1½ inch. : 4⅛ inch. = 1 : 2·75.
- In Chimpanzee[1] = 15·5‴ : 32·5‴ = 0·48 : 1.

e : f.
- In Orang = 4¼ inch. : 1⅞ inch. = 1 : 0·44.
- In Man = 6–7 inch. : 3–4 inch. = 1 : 0·50, or 1 : 0·42.
- In Chimpanzee[2] = 99 mil. : 43 mil. = 1 : 0·43.

The following six measurements of height, breadth, and length of the human cerebral hemispheres, are the three maximum and the three minimum measurements given by Huschke, at the ninety-ninth page of his work, already referred to:—

Maximum height in Chinese	= 155 mil.	Minimum in Hindoo Fakir	= 124 mil.
„ breadth in Inca	= 173·3 „	„ Croat	= 103 „
„ length in Croat	= 200 „	„ Inca	= 151 „

From these measurements it is evident that the variations of height oscillate within narrower limits in the human brain than the variations either of length or breadth. The measurement of height, therefore, would seem to possess greater serial importance than either of the other two measurements. Yet the following measurements will show that it is precisely in this dimension that the brain of the apes stands in the greatest relative inferiority to that of man.

Length of hemispheres in Orang	: length in Man	= 4¼ inch.	: 6–7 inch.	= 1 : 1·4 or 1 : 1·64	
„ „ Chimpanzee	: „	= 99 inch.	: 6–7 inch.	= 1 : 1·54 or 1 : 1·79.	
Breadth of „ in Orang	: breadth in Man	= 3¼ inch.	: 4–7 inch.	= 1 : 1·23 or 1 : 2·15.	
„ „ Chimpanzee	: „	= 95 m.[3]	: 4–7 m.	= 1 : 1·08 or 1 : 1·88.	
„ „ „	„	= 87 m.[4]	: 4–7 m.	= 1 : 1·17 or 1 : 2·06.	
Height of „ in Orang	: height in Man	= 2⅛ inch.	: 5 inch.	= 1 : 2·35.	
„ „ Chimpanzee	: „	= 54 m.[3]	: 5 m.	= 1 : 2·38.	
„ „ „	„	= 64 m.[4]	: 5 m.	= 1 : 2.	

Of all the differences of measurements and their relations as yet adduced, the difference between the relative heights of the human and the simious brains seems the most important.

Small as the difference in the two measurements of corpora callosa may seem, we must yet record that posteriorly to the posterior bourrelet or rounded edge of that body in the orang, the corpora quadrigemina came into view when the brain was removed from the skull. This observation will be seen later to have, when coupled

[1] Schrœder Van der Kolk, citt. Huschke, l. c., p. 82.
[2] Idem, Ibid., p. 129.
[3] Ibid.
[4] Gratiolet, 'Mémoire,' p. 54.

with certain others, considerable value, as showing the greater relative shortness of the corpus callosum. It was noticeable that the anterior pair of corpora quadrigemina were less sharply marked off from the posterior than in man.

The central notch of the cerebellum was much shallower relatively than in man, a point to be recollected in connexion with the relations stated to exist between the transverse *d* and antero-posterior diameter *c* of the cerebellum.

It is under our third head, that, namely, of the differences which M. Gratiolet's work has enabled us to describe, and we might almost say to discover, that the most important points of our comparison will be found. Under this head will fall the points which were mentioned in Professor Huxley's article[1], as the second and third points of difference, absolutely distinguishing the brain of man from that of the ape; and under it also may be ranged those which M. Gratiolet[2] lays stress upon, as indicating a relative inferiority in the African to the Asiatic ape.

To begin with 'the external perpendicular fissure.' This fissure, or a part of it, is visible in Fig. i, below *a*; in Fig. iii, between *a* and *a*. It is well represented in most of the simious brains figured by M. Gratiolet; it may be seen in Fig. i, Fig. ii, Fig. iii, Fig. vi, at *f* in Tab. i of Tiedemann's Icones of the brain of the *Simia nemestrina*, *Simia rhesus*, *Simia sabæa*, and *Cebus capucinus*. It will be seen a little later that it is not beside the purpose to remark that it may be better seen in Tiedemann's[3] figure of the brain of an orang on one side than it is on either side of his representation of the brain of a chimpanzee; and that it is very well marked on both sides, in a drawing of a brain of a young orang given by Professor Wagner, in a work[4] written with express and constant reference to M. Gratiolet's labours. Lastly, this fissure is very well seen in the representation of the brain of the chimpanzee given by Professor Owen in his paper in the Linnaean Society's Proceedings, January 21, 1857, Fig. iv, p. 19, and in his Reade Lecture, Fig. vii, p. 25. The inward prolongation of this fissure is never filled up, see 16, Fig. iv. It is upon the degree to which its outward prolongation is

[1] 'Nat. Hist. Review,' No. 1, p. 83.

[2] 'Mémoire,' pp. 51, 62.

[3] Tiedemann, ap. Wagner, 'Icones Zoot.' Taf. viii. figs. 2 and 3.

[4] 'Vorstudien zu einen wissenschaftlichen Morphologie und Physiologie des Menschlichen Gehirns als Seelenorgan,' von Rudolph Wagner, Göttingen, 1860.

filled up or not filled up, bridged or not bridged over, that the absence or presence of an external perpendicular fissure, the existence or non-existence of an 'operculum,' depends.

In the figures referred to, and to some extent in those appended to this paper, the anterior edge of the occipital lobe is seen to rise wave-like as it were against the table-land of the fronto-parietal lobes. The wave-like edge is the 'operculum.' Along the middle line on each in Fig. i, Fig. iii, and Fig. iv, the wave-like edge, speaking of disruption of continuity between the occipital lobes and the mass of brain anterior to them, is absent; a convolution, *a*, *a*, passes across what would else be a chasm. This convolution is the 'premier pli de passage' of Gratiolet; it comes, according to that authority, thus to the surface, and thus bridges the chasm in man, in the orang, and in the ateles, but in no other ape. Our first canon can be immediately applied in the estimation of the value of this structure upon the data thus put before the reader upon the authority of M. Gratiolet. Leaving the task of so applying it to the reader, I shall proceed to show that the superficial position of this bridging convolution is by no means an universally present characteristic either of the human brain or of the orang's; and, thirdly, that it is sometimes both present and superficially visible in the brain of the chimpanzee.

Of seven human brains at present in the University Museum, three possess this bridging convolution on both sides entirely superficial in position: in the fourth we find it wanting on one side, two spurs thrown out from the declivity of the occipital representing what is a perfectly continuous chain on the other side: in the fifth it is concealed on one side by the overhanging edge of the occipital lobes: in the sixth it does not quite reach, on the left side, the level held by the occipital and parietal lobes which it connects: in the seventh, a deep chasm is visible on both sides; but on the left the convolution, which seems to fail to bridge the fissure, does really cross and fill it up, though at a distance of as much as an inch from the longitudinal fissure; whilst on the right side the connecting convolution dips vertically downward, and leaves a deep valley between the occipital and parietal lobes. This seventh brain belonged to a man who, by trade a gardener, was possessed of more than an average share of intelligence, and whose brain was carefully preserved for this reason, as well as on account of its great size, and

the development of its convolutions. This last of the seven brains will allow us to apply our second canon to test the value of the absence of this structure in the particular relation of superficial position as a mark of serial degradation.

But a structure which exhibits so much variability, as to conform to the rule in but three, and to diverge more or less from it in four, out of seven brains chosen at haphazard for examination, as being all at that moment which a particular museum contained, will scarcely seem to merit a high place as a zoological differentia. With reference to the 'premier pli de passage' in the orang, a careful comparison of the relations of the parts lettered *a a*, in Fig. 3, with the same relations in Fig. 4, will show that this convolution is by no means superficial in its entire extent on the left side of that brain. And, secondly, in our second specimen of an orang's brain, this convolution is concealed on both sides within the fissure; and the cerebral hemispheres in this specimen present, in consequence, as perfectly wave-like an opercular edge as in any other monkey. In confirmation of this, I would appeal to Tiedemann's[1] and Wagner's[2] figures, already referred to, as giving typical representations of an external perpendicular fissure in the brain of orang utangs, in which, according to M. Gratiolet, it should be invariably half-filled up by his 'premier pli de passage.'

Lastly, with reference to the chimpanzee: our specimen possesses on its right side a well-marked, superior bridging convolution, coming for a considerable part of its length nearly or quite to a level with the lobes it connects. Tiedemann's figure of the chimpanzee's brain leads us, by its imperfectly marked operculum, to the same conclusion as its sharply drawn one did in the case of the orang. The law of correlation of forms is a safe guide to us, when we have to predict what will be found in the lower organisms of well-marked families; it loses its inflexibility, and becomes but a leaden rule, when we come to examine the most perfectly evolved species in such families. In the higher species of the order, apes, as in the higher varieties of the species, man, we find variability the rule, uniformity the exception; in the lower species, as in the

[1] Wagner, 'Icones Zoot.' viii. 3.

[2] Ap. Wagner, 'Icon.' Taf. viii. fig. 2. But Bischoff, p. 77 of his paper on the Grosshirnwindungen, says that Wagner had not taken away the pia mater, and that when he took it away a first pli was visible only with its posterior segment hidden in the external fissure.

lower varieties of man, the reverse condition obtains. The variability which we have seen to exist in the species chimpanzee is no inconsiderable proof of its high relative rank in its own order.

But there is a second connecting bridge passing between the occipital and the parietal lobes. This convolution is invariably present, and invariably superficially placed in man; it is as invariably absent in both the anthropoid apes. In man it is always a large, easily recognisable structure; and in cases such as those which our fourth human brain may be taken to exemplify, or exaggerate, it will be often found to send a branch, as it were, in aid of the weakened superior bridge. The vacuity which in the apes corresponds to what is invariably a convolution of importance in man, may be seen in Fig. 1, immediately posteriorly to *6*; and in Fig. 3, immediately below *a*. But this convolution, the 'deuxième pli de passage' of Gratiolet, absent without exception in the Old World apes, and present equally invariably in man, is found also in two New World monkeys, the *Cebus capucinus*[1] possessing it without, the Ateles possessing it in company with its fellow[2].

There is yet a third structure—'the lobule of the marginal convolution'—to be treated of. In man it lies above the upper end of the fissure of Sylvius; and it may not unfairly be represented in our Fig. 1, by the convolution which lies immediately to the spectator's left of 5. Of it M. Gratiolet speaks in the following language: 'Ce lobule est particulier à l'homme et ne se retrouve ni dans l'orang ni dans le chimpanzé[3].' But I find nowhere in M. Gratiolet's work any repetition of this striking statement: indeed it loses a good deal of its force, when we find the qualifying words 'souvent assez grand' applied to this peculiarly anthropic lobule in the sentence immediately preceding the one we have quoted. And in the coloured diagrams, which speak so plainly, by their various hues, of the varied relations in extent and arrangement which may obtain among different brains, I find no separate colour assigned to this peculiarly separable lobe. No such distinction is awarded to them as there is to the bridging 'plis de passage;' which, nevertheless, are not asserted to be exclusively anthropic. These considerations make me suspect that more weight has been attached to M. Gratiolet's words, as above quoted, than he would have wished

[1] Gratiolet, 'Mémoire,' 1854, p. 78. [2] Ibid. p. 76. [3] Ibid. p. 60.

them himself to carry; and anatomical investigation seems to me but to strengthen the argument based upon these literary considerations. For this 'lobule of the marginal convolution' is very frequently asymmetrical on the two sides of the same brain, and its development in any two human brains taken at haphazard is pretty sure to present the very greatest differences. Varying, as it does, most widely in absolute size, it varies also in showing 'rien de constant[1]' in its relation to certain other parts; its value can hardly be high, therefore, as a serial characteristic.

The convolution numbered 4 in Fig. 1 and Fig. 3, the 'premier pli ascendant' of Gratiolet, is separated by a vertical more or less interrupted fissure from the horizontal-lying frontal lobes 2 and 3. Now, a line drawn down the long axis of this fissure would fall a considerable way in front of the commencement of the fissure of Sylvius. Such a line in the human brain falls always far behind the commencement of that fissure, joining it, indeed, some way behind the angle where the fissure of Sylvius makes its bend horizontally backwards. The forward position of this line speaks more strongly than can the vertical direction of the fissure of Sylvius, of stunted antero-posterior growth of the frontal lobes, and it deserves more attention than it has yet received. The convolutions, No. 3, the superior frontal convolutions, are of all the convolutions those in which by symmetry and simplicity, both alike sure marks of degradation, the orang's brain contrasts to the greatest disadvantage with man's. But this fourth and this fifth point we shall leave to be elucidated by the reader for himself from an examination of our figures. We will state, however, the details which an examination of the chimpanzee's brain, instituted with a view of seeing whether its convolutions were really more symmetrical and more simple than those of the orang, elicited, in confirmation of M. Gratiolet's views. In the orang, and in the chimpanzee, both the frontal, 1, 2, 3, the 4 and 5 ascending parietal, and the superior bridging convolutions *a*, *a*, are asymmetrical on the two sides of the brain. The occipital *D*, the temporo-sphenoidal *B*, and the convolutions *b*, *b*, *b*, named 'pli courbe' by M. Gratiolet, are symmetrical in the champanzee, but asymmetrical in the orang. The occipital lobe is both more simple and more

[1] 'Mémoire,' l. c.

symmetrical in the chimpanzee than in the orang, but it is not larger in size. Both ascending convolutions are a little more simple in the chimpanzee than in the orang.

Having arrived at our last head—that, namely, of such differentiae as are detectable by dissection only—we will proceed to lay them before the reader in the shape of a short account of the dissection which disclosed them.

The right cerebral hemisphere was removed down to the level of the corpus callosum, as seen in Fig. 4. At a point relatively much further distant from its posterior edge, 14, than is the case in man, we see the internal perpendicular fissure, 16. Posteriorly again to this fissure, and running nearly parallel with it, we see a second, 17, the 'scissure des hippocampes' of M. Gratiolet. Corresponding with this indentation, we have within the cavity of the ventricle an eminence, 19, the lesser hippocampus, bounded by an arm or creek running up, 18, along its outer surface from the central ventricular expanse. This arm or creek was called, by another metaphor than those we have used, the third *cornu* of the lateral ventricle, in the phraseology of the old anatomists. The large smooth headland into which the hippocampus swells at 19, justifies the expression we find at page 16 of M. Gratiolet's work, 'L'anfractuosité d'ergot . . . *qui est plus évidente encore dans les Singes que dans l'Homme.*' In the brain of a cercopithecus now before us, its proportions are very much larger. The width of this third cornu was at its commencement three-eighths of an inch; and the similar cavity in a human brain examined at the same time was of the same width. But the cavity narrows much more rapidly in the orang than in man; and before reaching its termination, at a distance of one inch from its commencement, it becomes almost a linear cavity; but, as our figure shows, the distinctness of its limiting walls and the continuity of its lining membrane were unambiguously visible up to its very extremity. The length of this third cornu is as great absolutely and relatively, therefore much greater in the cercopithecus than in the orang. In the human brain it was but half an inch longer than in the orang, scooped out though it was in a posterior lobe relatively very much longer. Neither in the cercopithecus, nor in the orang, does the bourrelet or posterior rounded edge of the corpus callosum extend nearly so far back as to allow us to take it as 'the best

measure of the position' of the third cornu[1]; indeed, when we find Tiedemann speaking of the 'pedes hippocampi minores' as 'processus[2] duo medullares qui a posteriore corporis callosi margine proficiscuntur,' it is easy to understand how he came to overlook their existence altogether, 'in cerebro Simiarum desunt,' being so far in error as to their relations to neighbouring parts.

The relation of the posterior edge of the corpus callosum to the commencement of the third cornu is of importance, not merely as a guide to the discovery of that fissure, but also as, when coupled with the relations which the corpus callosum holds to the internal occipital fissure, 16, laterally, and to the corpora quadrigemina posteriorly, speaking unambiguously of great diminution of the antero-posterior diameter of the simious corpus callosum.

The hippocampus major presents several well-marked corrugations on the expanded lower extremity, 'quae huic parti tanquam figuram digitorum pedis tribuunt[3];' but as they are on its posterior, not on its anterior edge, we are not compelled to contradict Tiedemann's twenty-first corollary, which relates to the hippocampus major, in the same way as our figures compel us to differ from his twenty-second, quoted above, with reference to the hippocampus minor.

It is for the sake of illustrating yet further the important principle, that variability of arrangement is to be expected, rather than wondered at, in organisms as high as those of these apes, that I add the following observations as to the convolutions on the internal aspect of the hemispheres. There is scarcely any indication of a lobulus quadratus[4], the structure representing it resembles but little the figure of it as given by M. Gratiolet in his third plate, whilst, as if in compensation, the superior marginal convolution, spoken of by him as 'très simple et à peu près lisse dans l'orang' (page 49 in his Mémoire), presents, in our specimen, abundant and rich convolutions.

[1] 'Nat. Hist. Review,' l. c., p. 79.

[2] 'Icones,' p. 51.

[3] 'Icones,' p. 51. But in a work or paper published 1826, Tiedemann acknowledges the existence of the digitiform process in the orang. Cf. St. Hilaire, 'Hist. Nat.' ii. p. 221.

[4] This quadrilateral lobule is spoken of in the 'Anatomie Comparée,' Tom. ii. 1857, p. 115, as 'un petit lobule quadrilateral, que de petites incisures subdivisent.' This I had not seen when I wrote as above. P. 45, 'Il n'existe jamais dans les singes et ne se voit pas toujours dans l'homme.' Cp. Wagner, 'Vorstud.' ii. pp. 32, 33, where it is said to be present 'bei der Mehrzahl der Menschen.'

The internal anatomy of the simious brain does not furnish us, then, with those sharply differentiating characteristics which have been supposed to put it into a position of such marked inferiority to that of man.

As to the external anatomy, whilst too little importance has perhaps been assigned to the points of difference which the very widely differing antero-posterior diameters of the corpora callosa, and of the frontal lobes, and the very widely differing absolute weights of the two brains, constitute, too much seems to have been given to the 'absence of an external perpendicular fissure,' to the 'presence of a lobule of the marginal convolution,' and to the lesser relative size of the nerves in the human brain. Upon most other points, I find myself in agreement with most other writers, both as to facts and to inferences; the cumulative weight of the many minor points of agreement and difference, the reader will be best able to appreciate, by massing each order of facts together for himself.

The principles of the idealist teach him that the difference which exists between the soul of man and the life of the beast which perishes, is not one which can be weighed or measured, be drawn or figured, be calculated in inches or ounces. He fearlessly acknowledges that the anatomical truth in this matter lies on the boundary line of the conterminous positions taken up by Buffon and Professor Huxley, respectively; for he feels that yet higher truth is expressed in the golden words but recently rescued from long oblivion:—

> 'On earth there is nothing great but man;
> In man there is nothing great but mind.'

Description of Plate I.

These four views of the brain of the orang are copies of photographs taken of it by Messrs. Hills and Saunders, of Oxford. The brain had been carefully hardened in spirit for as much as two months before it was thus photographed. The figures are numbered in the order in which the photographs were taken. The numbers placed upon the convolutions on the exterior surface of the brain will be found to correspond with those similarly employed by

M. Gratiolet in his invaluable 'Mémoire sur les Plis Cérébraux de l'Homme et des Primates,' so often referred to.

Fig. 1 is a lateral view of the brain of the orang. It shows the following points:—

i. The even curve described by the superior boundary line of the hemispheres.

ii. The vertical direction of the fissure of Sylvius, F.

iii. The failure of the posterior lobes to cover the cerebellum entirely.

iv. The diminished downward growth of the posterior lobes, as shown by the obliquity of a line drawn along their surface where it lies upon the cerebellum, C.

v. The presence of the outer part of the lateral vertical fissure, which outer part is always filled up in man, even when the inner may not be so, as the inner is in the orang.

Fig. 2 is a basal view of the same brain. It shows the following points:—

i. The great relative thickness of the nerves to the mass of the brain. (See Gratiolet, 'Bull. Soc. Anth.' iv. 1861, p. 252.)

ii. The absence of any marked excavation of the orbital lobes.

iii. The lateral and posterior development of the cerebellar hemispheres.

Fig. 3 represents the brain of the orang as seen from above. It shows the following points:—

i. The greater extent to which the cerebellum has come into view on the left side than on the right.

ii. The want of symmetry between the two sides of the cerebellum. The longitudinal fissure seems on the left to be bounded by a continuous vertically unindented table-land, on the right by a table-land indented at two points. The posterior of these two points corresponds to the external vertical fissure, the first or superior pli de passage *a a* being partially concealed under the operculum, and allowing us thus to mark off the occipital from the principal lobes nearly as sharply as in the chimpanzee. The three frontal convolutions, 1, 2, 3, the two ascending parietals, 4, 5, and the lobule of the second ascending convolution, 5′, are asymmetrical on the two sides of the brain.

iii. The absence of the second pli de passage is well seen on both sides of the brain; and the wave-like anterior edge of the occipital lobes constituting the 'operculum' is especially well marked on the right side.

Fig. 4. Brain of orang dissected, so as to show the lateral ventricle of the right side, its three cornua, and the hippocampus minor, 19. It shows, besides, the different relations which the bourrelet of the corpus callosum holds in the ape and in man:—

i. To the commencement of the third cornu, 18.

ii. To the internal perpendicular fissure, 16.

iii. To the hemispheres which it connects.

1. Inferior frontal convolution.—'Étage frontal inférieur' of Gratiolet.
2. Middle frontal.—'Étage frontal moyen.'
3. Superior frontal.—'Étage frontal supérieur.'
4. First ascending parietal.—'Deuxième pli ascendant.'
5. Lobule of second ascending parietal.—'Lobule du deuxième pli ascendant.'
6 and 6′. Convolution running below, and parallel with the lower lip of the Sylvian fissure.—'Pli courbe.'
7. Lower lip of Sylvian fissure.—'Pli marginal inférieur.'
10. Superior occipital convolution.—'Étage supérieur du lobe occipital.'
11. Middle occipital convolution.—'Étage moyen.'
12. Inferior occipital convolution.—'Étage inférieur.'
13. Corpus striatum.

Fig. 1

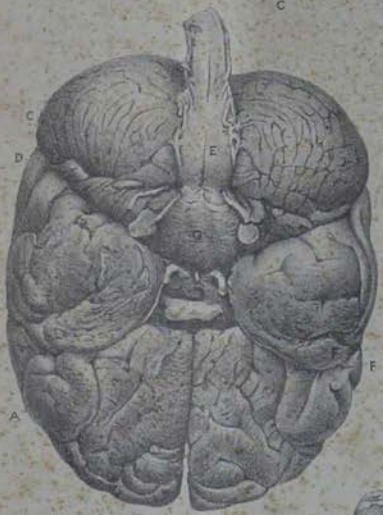

Fig. 2

Fig. 3

Fig. 4

BRAIN OF ORANG.

14. Posterior edge of corpus callosum.
15. Fornix.
16. Internal occipital fissure.
17. 'Scissure des hippocampes.'
18. Third cornu of lateral ventricle.
19. Hippocampus minor.

A. Anterior lobes.
B. Middle temporo-sphenoidal lobe.
C. Cerebellum.
D. Occipital lobes.
E. Medulla oblongata.
F. Fissure of Sylvius.
G. Pons.

a. Convolution connecting the superior occipital convolution (10) to the lobule of the second ascending parietal 5'.

II.

ON THE AFFINITIES AND DIFFERENCES BETWEEN THE BRAIN OF MAN AND THE BRAINS OF CERTAIN ANIMALS.

I HAVE here seven drawings, some more, some less diagrammatical, in illustration of my subject,—'The Affinities and Differences between the Brain of Man and the Brains of certain of the Lower Animals.' The two figures on the sheet numbered I. represent dissections of the brain of the dog (*Canis familiaris*) and of the brain of a monkey, the vervet (*Cercopithecus lalandii*); the brain of the monkey is to the left, that of the dog to the right in the drawing. Sheet II represents similarly prepared dissections of the brain of man and of the brain of an American marmoset monkey (*Hapale penicillata*), holding the same relative positions as the preceding. These four drawings are intended to illustrate the structures known as the lateral ventricles, and to show, further, what relations of overlapping or of outcropping the lesser, after brain, or cerebellum, may stand in to the upper and larger brain, known as the cerebral hemisphere. They are drawings of dissections made within the last fortnight at the Oxford Museum. The other eight figures are either exact reproductions of figures given in M. Gratiolet's celebrated and authoritative work on the Cerebral Convolutions[1]; or as in the single case of Sheet III, they are the result of the application to his uncoloured plates of the plan of colouring which Cuvier was wont to employ, and of which M. Gratiolet has himself made such excellent use. The object of these eight figures is to make intelligible what in former days was, in no exaggerated metaphor, spoken of as the 'chaos of the convolutions,' and to enable us hereby to take a scientific estimate of

[1] Paris, 1854, Bertrand, Editeur.

these complex structures in the two subjects of our comparison. Sheet III figures at *a* the brain of an European; at *b*, that of a Bushwoman, known as the 'Hottentot Venus.' Sheet IV gives, above, the brain of an orang; below, that of a chimpanzee. Sheet V, above, the brain of a mandrill; below, that of the American spider (*Ateles belzebuth*). Sheets VI and VII, though borrowed from M. Gratiolet, might have been taken from the external surface of the left cerebral hemisphere of the self-same vervet monkey, the right hemisphere of which is dissected and delineated in Sheet I. Its simple brain will be used as a clue to guide us through the tortuosities of its more complex fellows.

Before entering upon the detail of the facts which these figures are intended to elucidate, or help in elucidating, it may be expedient for me to pass in review the various sets of opinions or feelings which men may bring with them to such investigations. Some persons may be content to turn away from the consideration of any possible anthropological bearing which this subject will generally be held to have, to receive the facts simply as facts, and to abstain from employing them as premises to this or that conclusion. To such persons I would say, that all the results which recent investigations have elicited with reference to the points of agreement and difference which are the subject of this evening's lecture, can refer for confirmation to the photographic process, the testimony of which is unimpeachable, as the sun has as few theories to support as the most thorough-going of positive philosophers, and could not mislead even if he would.

But most men will come to a lecture such as this with the intention of reading its facts into the language of one or the other of two schools of modern physical speculation,—the Materialistic or the Idealistic,—and with the teaching of either one of these may be combined either view of the origin of species. Thus there may be four sets of opinions with which the phenomena of which I shall in a moment speak will have to be harmonised: materialism, to wit, coupled with a belief in the immutability and primordial distinctness of species; materialism coupled with a belief in the theory of development; idealism united with the tenets of special creative acts both as to body and mind; idealism, lastly, united with developmental views as to bodily structures. None of these four sets of views necessarily, or at all events actually, entail what

the French speak of as 'conséquences désastreuses, funestes pour la morale.' The susceptibilities of no one, therefore, need be offended by his being told that he must necessarily take up for himself one or other of these four sets of dogmas, unless he be content to put himself into the somewhat inert position of passively receiving the facts, and drawing no deductions from them. I must add, that I cannot see that the holding of any one of these four sets of opinions is necessarily incompatible with a belief in the details I shall have to lay before you. Stubborn as are facts, especially when photographed, they are nevertheless elastic enough to bear being compressed within any one of these four formulae without losing their own distinctive character, or destroying the framework employed for their colligation. That these four theories are all true together, of course I do not mean to assert; three of them must, in the very nature of things, be erroneous; but I do think that, to be assailed successively, they must be attacked with other weapons than any which anatomy, whether human, simious, or canine, can furnish.

The cerebro-spinal system of the vertebrate animal consists of a central stem and of peripheral ramifications. Of the peripheral ramifications we are not about to speak, and of its central stem we shall only compare that part in each of the subjects of our comparison which is contained within the cranial walls. This part of the cerebro-spinal centre, like the other part contained within the canal constituted by the spinal column, is essentially—that is to say, morphologically and developmentally—as well as actually in the adult state, but a hollow tube with walls of nerve matter. These walls are variously thickened, have larger and smaller nodules of nerve substance developed in, around, and upon them, and finally, their exterior surface becomes more or less completely corrugated into convolutions. Still the essential nature of the nervous centre remains within the skull, the same as within the column of vertebrae, viz. a nervous tube. The difference between the intra-cranial and the intra-spinal nerve tube is, that the intra-cranial effloresces or buds out at its upper or anterior extremity into two out-growths, which are folded back upon it as they grow out, and expand into the nerve masses which, under the name of Cerebral Hemispheres, fill by far the larger part of the skull cavity. It is with these terminal dilatations of the hollow central nerve stem

alone, and not with the intra-cranial masses which they overlie, that we shall have to deal when contrasting the human with the simious and other animals, for it is in them that we find more marked differences existing than elsewhere in the entirety of the softer parts of the compared organisms, and it is in them that we should anticipate the finding of such differences from what we all know of the correlation subsisting between mental phenomena and the greater or less evolution of these structures. And, secondly, though less attention has been paid to any differences which may exist between the rest of the intra-cranial nerve stem—between the spinal cord and the peripheral nerve-ramifications throughout the body in the two sets of organisms to be compared—that less attention has nevertheless been sufficient to show that these differences are of infinitely less moment than those which a comparison of the cerebral hemispheres enables us to elicit.

We will commence with a description of the interior of the cavity included within the cerebral hemispheres which we shall have to compare, and proceed, in the second place, to contrast their external surfaces in their simple outlines and in their complex convolutions; we will conclude by stating the differences which measures show to exist between the connecting floors, and weights show to obtain between the entire mass of the intra-cranial nerve-centres in the one and in the other set of organisms.

The question as to the difference between the human ventricular cavity and that of the ape's may be thus stated,—Has the ape such a ventricular cavity tri-radiate, three-horned, as has the man? or has it a ventricular cavity bi-radiate and two-horned, as has the dog? The two-horned ventricle of the dog is seen in figure 1 *a*, exposed in the interior of the right hemisphere. The ventricular cavity of the African vervet monkey is shown in figure 1 *b*; the ventricular cavity of the American marmoset in figure 2. It is clear enough that the African monkey has that which the dog has not, that the former animal has a horn-shaped, finger-shaped creek, turning up into what is in the dog a solid unindented mass. That horn, finger, creek-shaped cavity was in the monkey $\frac{5}{8}''$ in length, the entire length of its brain being little ($\frac{1}{16}''$) over $2\frac{1}{4}$ inches; the analogous, or homologous cavity in the human brain was 1″ in length, $\frac{3}{8}''$ longer than the vervet's, albeit its hemispheres were $6\frac{3}{4}''$ as against $2\frac{1}{4}''$. In the American monkey

that the same parts exist as in the vervet and in man is plain enough, in all three alike is there a triply-divided ventricular cavity, but relatively the posterior compartment is enormously larger in the American monkey, and the now notorious hippocampus minor it contains is enormously larger also than the homologous structures in either of the two brains between which it stands. The third cornu or horn in the marmoset is a bay in comparison with the other two cornua, and they are in relation to it but creeks and inlets; the relations of the three compartments are entirely reversed. The hippocampus minor is a huge island; the hippocampus major but a boomerang-shaped reef; the relations of the contained parts are entirely reversed also. As the facts, then, of comparative anatomy stand, the semi-simious marmoset has, relatively to its size, a larger hippocampus and a larger posterior division of its ventricular cavity than has the true Simiada, *Cercopithecus lalandii*; the *Cercopithecus lalandii* has a larger hippocampus minor and a larger posterior cornu than has man himself. So much for what is called the serial or classificatory value of these structures as differentiating us from the lower animals. Two words upon their physiological importance. The dog is gentle and docile, capable of education and of forming attachments, yet he lacks obviously what the ape as obviously possesses. Secondly, a glance at a rabbit's[1] brain (similarly dissected) will show, when compared with that of the dog's, that the ventricular cavity has encroached upon and eaten away what in its canine enemy is a solid mass of nerve matter. A large cavity is correlated with little neurine, but the neurine, and not the ventricular cavity, is what the mind works with. Basing one's hopes and trust upon neurine and hippocampi is basing them upon something solid, even though it be but sand; basing them upon a ventricle's creek is but basing them upon the sea.

The hippocampi have always been dangerous ground for the anatomist, the hippocampus major in days gone by, as the hippocampus minor in our own. The boomerang-shaped body so visible and so vertical in the dog's brain, plain, but not so plain, because more horizontal in the simious and human encephala, is the hippocampus major; an indentation in the drawing from the human

[1] My attention was drawn to this point by Charles Robertson, Esq., of the University Museum.

brain marks off a claw-like ridge on the blunted lion-paw-like end of the structure. There might be, there often are, several such indentations, several such claw-like ridges, in the particular brain figured, as often in others there is but one. This is much the language, by the way, which might be used of the hippocampus minor, not as to its claws, but as to its entire mass: the cases are parallel as to the literary history of the two structures also. For Professor Tiedemann, writing in 1821, at Heidelberg[1], said of these claws that they were found in man, and in him only. 'Homini peculiares esse videntur.' 'In cerebro Simiarum processus digitatos non vidi.' They enjoyed, however, but for a short time the pre-eminently important office of differentiating man from the ape. After a short reign of but five years, they were ruthlessly and for ever deposed from this exalted position by the same hand that had placed them in it. Tiedemann's son-in-law, Professor Fohmann, heard whilst at Leyden, in 1825, that among other natural history treasures amassed in Java by two naturalists, and sent home after their deaths in that deadly climate, there had arrived the brain of an orang-utang. His representations prevailed on Temminck and Sandifort to send this then all but unique specimen to Heidelberg. They were liberally minded and enlightened men, but his solicitations were, I suspect, somewhat urgent; I, at least, have not always found the managers of other museums so complaisant. An account of the dissection of this brain appeared shortly afterwards in the 'Zeitschrift für Physiologie' (the 'Natural History Review' for 1826), edited at Darmstadt by Tiedemann and the two Trevirani, and on its twenty-fifth page I read as follows: 'Each cornu ammonis (or hippocampus major) had its medullary band (the taenia hippocampi), as in man, and showed claw-like or knotty masses, which I had not observed upon the cornu ammonis of other apes.' The turn of the third cornu had not yet come, so Tiedemann goes on to say: 'The great lateral ventricles consisted of three horns, an anterior, a middle or descending, and a posterior horn.' Tiedemann, amongst other errors, had taught, in 1821, that the small size of the orang-utang's brain accounted fully for the smallness of its faculties, as compared with man's, and those of his disciples who had been adequately impressed with this notion, and believed besides that 'peculiar mental powers were

[1] 'Icones Cerebri Simiarum,' p. 90, Corollary xxi.

associated with that highest form of brain,' which possessed processus digitatos upon its hippocampus major, must have had their convictions rudely shocked by this retractation. The twenty-sixth page of the same memoir but added to the uncomfortable feelings of their materialistic minds; for it contains a specification of no less than five other points, in which the Asiatic anthropomorphous ape coincided with man, and contrasted with inferior simiadae. It is possible, however, that the teaching of Bossuet was more familiar to that generation than it seems to be to the present, for it had, as M. Isidore St. Hilaire hints[1], been reproduced for them in the then standard work of Buffon[2]. 'If,' says Bossuet (De la Connaissance de Dieu et de Soi-même, chap. 5, xii), 'organs are common to man and brute, one is necessarily forced to the conclusion that intelligence is not attached to organs; that it depends upon another principle'—'et que Dieu sous les mêmes apparences a pu cacher divers trésors'—an argument, the cogency of which, as M. St. Hilaire remarks, increases as the number of organs common to the two subjects of comparison becomes more numerous and their resemblance more striking.

To conclude the subject of the ventricular surface or internal cavity of the brains we are comparing: within the present month a drawing of the ventricular cavity of the orang-utang has been laid before the English public by two Dutch anatomists, Schroeder Van der Kolk and Vrolik. Nearly 150 years ago a very similar drawing of the human lateral ventricles, by the celebrated Eustachius, was given to the world in Lancisi's[3] edition of his but little more celebrated predecessor's plates. Those were the days of thorough-going anthropotomy, before attention to what the present Professor of Anatomy at Berlin calls *mikroscopische Spielereien* (Reichert, 'Bau des Menschlichen Gehirn,' ii. 22) had drawn men's minds away from dissection and description; and a testimony from their writings may therefore seem to have more weight than those of more modern times. The cerebellum comes into view in the figures of the Dutch anatomists, as will be explained as we proceed, and in this point the two figures of this month and of a century

[1] 'Hist. Nat.' tom. ii. p. 252.

[2] 'Hist. Nat.' xiv. p. 61.

[3] 'Tabulæ Anatom. Bartholomaei Eustachii,' ed. Jo. Maria Lancisius, Romæ, MDCCXIV. Tab. xvii. Figs. 3, 4, and 5.

and a-half ago differ; but so far as the ventricles go, the figures given in the current number of the 'Natural History Review[1]' might very easily be interchanged with that standing for human structures in the drawing of the anatomists, who had never dreamt of contrasting these organs with those of the ape. And should any one retaining any lurking kindness for the posterior cornu, come thus warped, to decide which of the two figures was intended for the simious, and which for the human brain, infallibly his judgment would be wrong. For the figure of the human ventricle drawn by the famous Eustachius, a name familiar to even the unlearned, and edited by the almost equally famous Lancisi, has one of its posterior cornua shortened and stunted and unsymmetrical, whereas the posterior cornua in the drawing of our celebrated Dutch contemporaries are large and well-defined, exactly symmetrical cavities. I cannot say whether the elder anatomists purposely drew these cornua of unequal size; certain it is that they very often are in nature as Eustachius has drawn them in three of the figures in his seventeenth plate; his letter-press is silent upon the point, to which, however, the brothers Wenzel spoke[2] unambiguously many years later.

The points wherein the human exterior surfaces and the simious brains coincide and those in which they differ can be arranged under two heads. Either they are such as the eye can judge of, even though its owner be not an anatomist *ex professo*, depending as they do upon outline and general configuration; or they are such as a deeply-going analysis of the complexity of the convolutions alone can elicit. For the power of describing this second class of differences at all we are indebted to M. Gratiolet, and by means of the lettered and numbered diagrams, which are taken from his work, I shall hope to make these differences and resemblances intelligible to you. To begin with the more easily intelligible class of distinctions, those which are based on general outline and configuration. Looking at a human and a simious cerebrum from above, it is easy to see that both being ovoid, the ape's brain is both more elegantly and more exactly egg-shaped. But elegance and exactness are here, as often elsewhere, purchased at the cost of strength and substance. The human ovoid is blunt because it is

[1] January, 1862, Plate IV.

[2] 'De Cerebro Hominis et Brutorum,' Tübingen, 1812.

broad; the simious is taper because it is narrow; the human outline is, viewed from above, irregular, but its irregularity is due to elongation, and is not merely a sign but a source of power; the ape's conforms more closely to the egg-type, but conformity to type is here in actuality, as in ontology, but a limitation of capability.

A profile view of the two brains, such as you may take from the diagrams, disregarding the letters and numbers, may have many of its results expressed in much the same terms. The human brain presents along its upper surface a long gradually-sloping table-land, which reaches its highest point a considerable way behind the middle point of the long axis of the organ. The line limiting the superior edge of the simious brain is all but a semicircle. Looking now at the inferior boundary line of the two hemispheres, we see that regularity and evenness have removed from the lower and become the characteristics of the higher brain. The unevenly projecting prominence numbered 7 and 8 is much larger relatively to the part of the brain which lies above it and before it in the ape than in man. This irregularity is due partly to excess, the anterior and posterior excavations in the ape's lower boundary line are due to defect of development rather than to the reverse. These points of difference are quantitative, they are considerations of more or less; and it is only fair to observe that the lower of the two human brains differs as to these very points to some extent, though not by any means to the same extent from the higher as the simious brains do from it. The often-mooted point of the overlapping or non-overlapping of the lower or after brain, the cerebellum by the cerebral hemispheres, may be set at rest by a reference to these diagrams. The cerebral hemispheres of the Hottentot's brain are seen to project further beyond the cerebellum than do the cerebral hemispheres of the white man's brain. The marmoset brain, albeit its owner was but squirrel-like in intelligence, as in outer form, has a largely overlapped cerebellum; the length of its hemispheres being $2\frac{5}{16}''$, the extent to which they projected beyond the cerebellum was $\frac{1}{8}''$. The squirrel monkey, properly so called (*Callithrix sciureus*), indeed outdoes the marmoset, its cerebral hemispheres overlapping the cerebellum by as much as one-fifth of their length[1]; and its superiority of intelligence we might be

[1] St. Hilaire, 'Hist. Nat.' ii. i. 249.

tempted to connect with this greater development of cerebral substance, but that the uncovered cerebellum of the dog stands before us in the same plate as the largely covered cerebellum of the vervet. I must say a word, however, here upon the relations of being overlapped and of outcropping, both laterally and antero-posteriorly, which the cerebellum holds to the cerebrum in the largest of the apes, for in them the cerebellum is much larger, and especially is it much wider, in relation to the cerebral hemispheres, than it is in man. In the lower monkeys, on a basal view, a broadish rim affords room enough for the anatomist's finger to travel all round the cerebellum, and the like is the case in man. In the chimpanzee, according to Mr. Marshall (from whose paper[1] I have already borrowed much), such a rim as this is traceable, though in more curtailed lateral and greater posterior proportions than in man around the cerebellum. In the orang the narrowed boat-like posterior lobes hold a less favourable relation, both laterally and posteriorly, to the underlying after-brain than they do in the African ape, but even in this ape there is, as casts of the skull cavity will show, no margin allowed us for speaking of an uncovered, outcropping cerebellum, at all events in the longitudinal direction. I put in this limitation because the celebrated Dutch anatomists, already quoted, seem to think that the very small segment of cerebellum, which peeps out on either side, though not in the middle line posteriorly of their figure, may perhaps have peeped out to some extent, though not to the entire extent represented, whilst the organ held their natural relation to each other. Not the least valuable part of Mr. Marshall's valuable paper is that in which he gives us an explanation of the way in which the relative positions of the different parts of the encephalon become altered when the organ is removed from the cranial case which supported it during life. This explanation will be valuable to the general public, for it will make clear what to them has been a mystery, viz. how anatomists can come to differ as to mere matters of measurement; showing how widely a brain preserved in spirit may differ from the same brain unsubjected to the working of that agent, it teaches us that no conscientious anatomist should describe a preserved brain without having side by side with it a cast of the skull whence it was taken. In the letter-press and in the figures of M. Gratiolet's invaluable

[1] 'Nat. Hist. Review,' July, 1861, p. 304.

work, published in 1854 (see page 2 of his 'Mémoire' and figures *passim*), we always meet with 'un lobe postérieur recouvrant complètement le cervelet;' but in a most striking paper of his, published in one of the April numbers of the 'Comptes Rendus' for 1860, p. 803, we find him allowing that the cerebellum is uncovered laterally by the cerebral hemispheres in no less an ape than the gorilla, now so familiar to our ears and eyes. This admission however of M. Gratiolet's—it is not an admission on his part, for he is not arguing, but stating what he has observed—does but little invalidate our reasoning, for in that paper we have such a description given of the brain of this would-be King of the Simiadae as—if brain structure is to be considered of any importance at all—justifies the describer in speaking of the gorilla as 'the last, the most degraded of all the anthropomorphous apes.' In the world of science, as in that of politics, France and England have occasionally differed as to their choice between rival candidates for royalty. In M. Gratiolet's paper we have his case laid before the world in a manner which other state papers might do well to imitate. If either hereditary claims or personal merits affect at all the right of succession, beyond a question the gorilla is but a pretender, and one or other of the two candidates the true prince. There is a graceful as well as an ungraceful way of withdrawing from a false position, and the British public will adopt the graceful course by accepting forthwith and henceforth the French candidate, and by endorsing M. Gratiolet's proposal for speaking of the gorilla as but a baboon, of the chimpanzee as a macaque, and of the orang as a gibbon. Before leaving this subject, which has something of the nature of a digression, it is perhaps worth while to remark that nearly ten years before M. Gratiolet came into the possession of the brain of the gorilla he had, from the consideration of the form of casts of its cranial cavity, been led to predict what the brain would be found to be whensoever it came to be examined. It is impossible to bring stronger proof of the accuracy and value of his method —the aim of seeing in science being that we may foresee.

One point of yet greater difference can be detected by the uninstructed eye as existing between the brains of men and the apes, from looking at the organs themselves, though not from looking at the figures of them, which are all drawn of nearly equal size. This point is the greater height of the human brain. Common language

indeed bears evidence to this characteristic of the human brain; we hear of a 'long-headed man' in common parlance, as of a dolicho-cephalic man in scientific, in contrast to a brachycephalic man and its trivial rendering; but it is in scientific books alone that we hear of, or rather read of aepycephalic[1] (Huschke, p. 100) or acrocephalic ('Crania Britannica,' Dec. ii. plate 12) men. The reason is simply this; men differ greatly as to the length of their heads, they differ little as to the height of them. It is obvious that it may be said that greater height means increase in quantity, implies greater force, more perfect function; but that it constitutes after all but a difference of degree, not of kind,—that the muscles of Milo of Crotona were not more truly muscles than those of the puniest of modern mortals because there was more of them; that, in a word, quantitative is not specific difference; and that, in French language, the greater altitude of the human brain is a difference of physiological, not of *serial*, value. To this, however, I would answer,—waiving for the moment my metaphysical objections to the distinction which is so frequently drawn,—that the fact of the highest of the apes differing more widely from the lowest of mankind in this very dimension of altitude than in either that of breadth or length, whilst the lowest of mankind differs less from the highest in this self-same dimension than in any other, does seem to me to confer something of a classificatory value upon it.

It is possible, however, that I am laying, and have laid upon another occasion[2], more stress upon this point than a conscientious record of an extensive number of measurements of human crania of various races, the encephalon not being accessible, would show it to be able to bear. Measurements, on the one hand, of crania known to have been artificially deformed would be excluded from such a list; while, on the other hand, for the argument to remain valid, absolute certainty must somehow be obtained as to the impossibility of such artificially produced deformities ever becoming hereditarily transmissible.

Mr. Marshall has shown that the chimpanzee's brain is most markedly inferior to the human brain in this very dimension of altitude, but it is fair to the subject to say that this discrepancy is less than what I found and recorded in the same periodical as

[1] Hochschädler.

[2] 'Nat. Hist. Review,' No. II., April, 1861, p. 209.

existing between the vertical radii of the orang and man severally. The frontal lobe was, however, in this respect, more markedly inferior in the African ape considerably than was his parietal; but for the explanation of these terms I must enter upon my third head, that, namely, of the differences which M. Gratiolet's analysis of the convolutions has enabled us to discover and describe. As it will henceforth be an impertinence in any one to write or speak upon the science of language without a due acknowledgment of his obligations to the lectures delivered upon that subject in this place by Professor Max Müller, so it would be an affront to the understanding and information of any scientific audience to address them upon the subject of the brain and ignore M. Gratiolet's labours. His 'Mémoire sur les Plis Cérébraux de l'Homme et des Primates,' published some eight years ago, is but a short treatise. Short treatises have, however, before now, revolutionised sciences.

The convolutions into which the exterior of the brain is folded are of three orders, primary, secondary, and tertiary. They are divided from each other by correspondingly winding indentations. The primary convolutions may be compared to the great ridges which in a mountainous country, running more or less parallel to each other and forming blocks and masses of more or less divergent directions, give it its distinctive geographical character. The secondary convolutions may not inadequately be represented by the indentations which we find on the broader table-land summits of many, if not all, of such ranges. Finally, the spurs which run down and interlock with similar spurs from opposite ranges may be taken as representatives of the tertiary convolutions. That such details, as I shall have time to go into, may become possessed of meaning and interest sooner than without such a statement they would be, I will say, that the primary convolutions, the great typical lines and ridges, are the same in the brains of the apes and in our own. 'L'homme,' say the Dutch anatomists already referred to ('Nat. Hist. Rev.,' No. V. p. 117), 'n'a rien dans son encéphale qui manque absolument aux singes.' The table-land summits may have their long backs but shallowly or not at all indented in the one class, while in the other they may be cleft down into as sheer and deep fissures as are the primary valleys themselves, but the general arrangement is the same in both in spite of these merely quantitative differences. The case, however, is somewhat different

when we analyse the tertiary convolutions. In one part of the brain, where two of the five great masses into which its convoluted surface may be mapped out abut upon each other, what are but connecting spurs in the ape's, overhung and concealed by the beetling parietal and occipital lobes, rise in man to the dignity of connecting table-lands, filling up and bridging over levelly what is a valley, or rather a chasm, in most simious encephala. Small as this difference may seem to be[1], it nevertheless corresponds with what has been spoken of as absolutely, with two other points, differentiating man's brain from that of the ape's under the head of 'the absence of the external perpendicular fissure,' and it corresponds also with the absence or presence of what has been figured in diagrams 3 and 5 in a larger or smaller mass of convolutions lettered *a* and *β*. These diagrams I must now proceed to explain by the aid of the yet simpler, yet not less truthful Figures 6 and 7. These last figures are taken from M. Gratiolet's work so often referred to, but they might have been taken from the outer aspect of the left cerebral hemisphere of the very brain from which the dissected right ventricle of Figure 6 was drawn. The oblique line which is lettered *S*, in what I will speak of as a vervet monkey's brain, is the fissure of Sylvius. Earliest to appear in the developing brain, it is the very last convolution which we lose in the simplified cerebrum of the lowest western monkey. From both the standpoints, therefore, of scientific anatomy, it is of primary importance, and to us it is the least moveable of all our land-marks. As it rises and forms an angle with the horizon, so the grade of the brain to which it belongs falls, and *vice versa*. Our second landmark is the fissure which is second also in order of appearance in the growing human, though not in the simious brain, the fissure of Rolando. It is a fissure which should be dear to the phrenologist, for whilst all other fissures and their limiting convolutions shift (Gratiolet's 'Système Nerveux,' tome ii. p. 115) about in different individuals as they are differently developed, from one region of the protecting skull roof to another, so that we are never justified in saying that any one convolution, which we could recognise and number accordingly in an exposed brain, will be found under such or such an osseous protuberance, which we may be passing our finger over ('promenant nos aveugles doigts,' as Gratiolet some-

[1] 'Nat. Hist. Review,' January, 1861, p. 83.

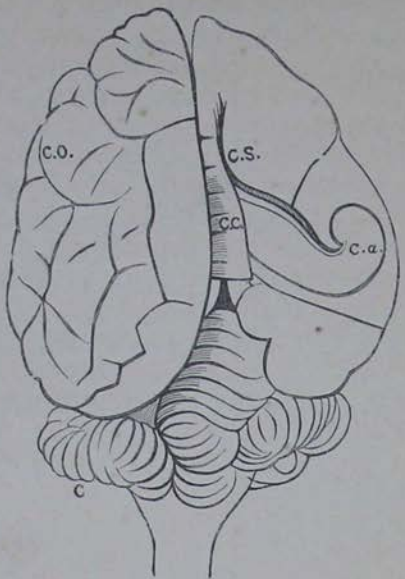

FIG. 1 *a*.—Brain of Dog, *Canis familiaris*, dissected so as to show its biradiate lateral ventricle. The right cerebral hemisphere has been removed to a level with the corpus callosum. *C.O.* cerebral hemisphere; *C.* cerebellum; *C.C.* corpus callosum; *C.a.* hippocampus major, cornu ammonis; *C.S.* corpus striatum.

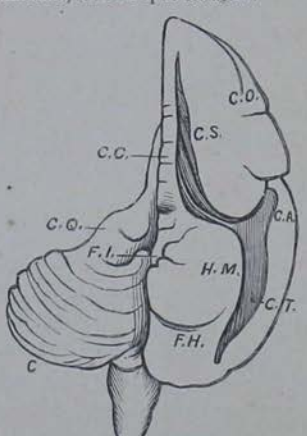

FIG. 1 *b*.—Brain of Vervet Monkey, *Cercopithecus lalandii*, similarly prepared, but with the left hemisphere entirely removed. The posterior edge of the corpus callosum is seen not to reach so far back as to overhang the corpora quadrigemina. *C.Q.* corpora quadrigemina; *F. I.* internal perpendicular fissure; *F. H.* fissure of the hippocampi; *H. M.* hippocampus minor.

where phrases it), we are always justified, *if* we can recognise the suture which limits the frontal from the parietal bone, in saying that under it will be found lying the convolution numbered 4 [1]. I know not what, nor whether any, functions have been localised along this sutural arc. Our third and last great boundary line is the so-called external perpendicular fissure which is lettered *E* in the Diagrams. It is upon the upgrowth in man within this fissure of convolutions (lettered α and β in the Diagrams), stunted elsewhere, that so much weight has been laid. They are in him connecting table-lands elevated from the lower position of spurs and sloping declivities. (See Figures 3 a, 3 b.) We see them neither in the chimpanzee nor in the mandrills. (See Figures 4 b, 5 a.) The external perpendicular fissure (*E*) has taken their place. In the orang (Fig. 4 a) and the Ateles (Fig. 5 b) we again see the letters α and β which betoken them. The lobe numbered 10, 11, 12, which they connect with one numbered 5 and 4, is the occipital; the one numbered 5 and 4 is the parietal. The fissure of Sylvius separates this lobe from the temporo-sphenoid, numbered 7, 8, 9. The lobe in front of the parietal numbered 1, 2, 3 is the frontal. We have become acquainted then with four great divisions in the brain surface, and that each admits of an easy division into three minor convolutions the diagrams sufficiently show. I shall not enumerate all the twelve with their distinctive peculiarities and several grades of development; the three divisions—the upper, lower, and middle stages as they may be called—of the frontal lobe are, however, of importance to us even in this hurried and imperfect comparison. The bridging convolutions have in name the physiological importance of a primary lobe; morphologically, of course, they cannot hold this rank. A lobe hidden from our eyes, and in the depths of the Sylvian fissure, holds just the reverse relation to morphological and physiological considerations, it is present in all the subjects of our comparison, and is the centre point round which the other convolutions can be most naturally grouped; but physiologically it is of little moment; known as 'the island of Reil' it completes the number, five, of which we spoke as being the number of the great brain divisions.

[1] [Gratiolet was in error in placing this convolution under the fronto-parietal suture, for the fissure of Rolando is always situated some distance behind that suture.—EDITOR.]

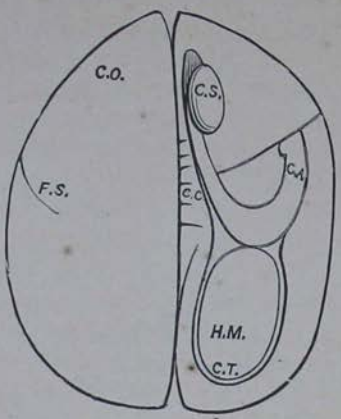

FIG. 2.—Brain of Marmoset, *Hapale penicillata*, prepared as brain of dog (fig. 1 *a*). *C. O.* left cerebral hemisphere; *F. S.* fissure of Sylvius; *C. S.* corpus striatum; *C. C.* corpus callosum; *C. A.* cornu ammonis; *H. M.* hippocampus minor; *C. T.* posterior or third cornu.

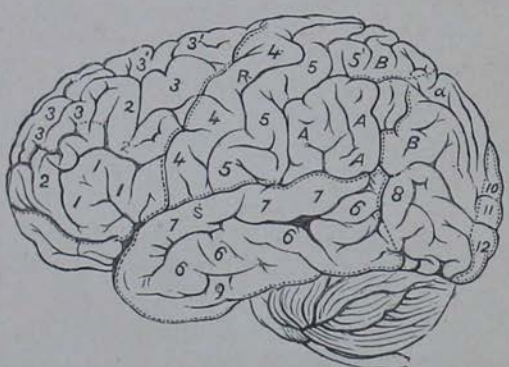

FIG. 3 *a*.—Brain of European, lettered and numbered after M. Gratiolet.

See also Fig. 3 *b*.

To commence with the lobe which is lettered α and β in our diagrams, which occupies so much space and has had so much importance assigned to it in the human brain, alike by Professor Huxley ('Natural History Review,' January 1861) and M. Gratiolet ('Mémoire,' p. 62), what is its meaning, signification, *Bedeutung*? is its importance serial or physiological, classificatory and specific, or functional and quantitative? M. Gratiolet's works give, it must be said, but one uncertain sound upon this point. Twice ('Mémoire,' pp. 89 and 76) he tells us that the Thumbless Spider Monkey (*Ateles belzebuth*) possesses 'par un exemple unique parmi les singes,' these convolutions in as perfect a state of morphological integrity as man himself, albeit one of them may be 'fort *réduit*.' On the other hand, I find M. Gratiolet (in the 'Mémoires de la Société de l'Anthropologie,' 1860, tom. i. p. 65) speaking of the coming level to the surface of one, the second of these bridges, as a character peculiar to man. And as if to put himself again in opposition to himself, I see in one of his own figures of a human brain, and that a well-developed one (Plate II. Fig. 1), a long unbridged fissure running continuously from this internal perpendicular fissure right across the upper surface of the hemisphere. In this last case, however, I suspect that, as is described by myself in the 'Natural History Review,' April, 1861, p. 211, the brain in question having belonged to a gardener, and a man of more than ordinary intelligence, this appearance of an unfilled-up chasm is due to excess rather than to defect of development; the bridging convolution, instead of crossing from one side directly to the other, having bent itself into a curve with its concavity upward so as to form thus a secondary valley within the primary fissure, an appearance almost unavoidably deceptive in a hardened and undissected brain. Professor Huxley, whose views as to the importance of this lateral perpendicular fissure I just now alluded to, seems in a recent number of the Zoological Society's 'Proceedings,' June 11, 1861, to consider this part of M. Gratiolet's analysis as somewhat unsatisfactory, and his identifications of these bridging convolutions to fall somewhat short of the certainty which attaches usually to his homologies. Still in his figures of the Coaita (*Ateles paniscus*) the occipital lobe is continuous with the parietal by a level table-land summit. Coupling the authority of others with observations of my own, I shall be inclined to rank the physiological value of these convolutions α and β as second only to those of the frontal

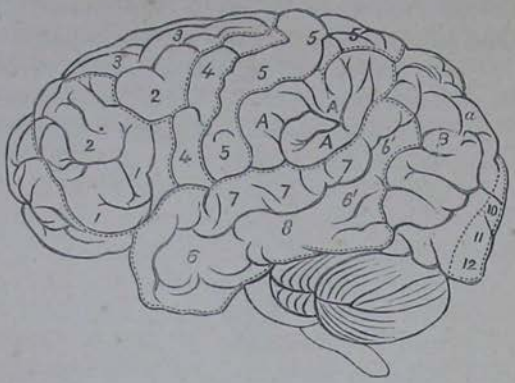

FIG. 3 *b*.—Brain of Bushwoman, known as the 'Hottentot Venus.' Like the preceding, a lateral view, after Gratiolet. 1, supra-ciliary convolution; 2, middle frontal stage; 3, superior frontal stage; 4, first ascending convolution; 5, second ascending; 5′, lobule of second ascending; 6′, curved convolution; 7, superior temporal; 8, middle temporal; 9, inferior temporal; 10, 11, 12, occipital convolutions; *A*, lobule of marginal convolution; (α) superior or first bridging convolution; (β) inferior or second bridging convolution.

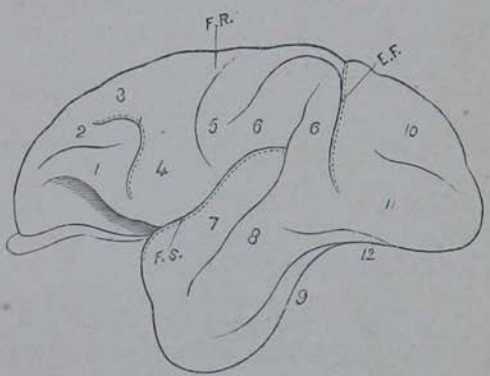

FIG. 6.—Left Cerebral Hemisphere of Vervet Monkey, *Cercopithecus lalandii*. 1, Supraciliary convolution; 2, middle frontal stage; 3, superior frontal stage; 4, first ascending convolution; 5, second ascending convolution; 6, curved convolution; 7, superior temporal; 8, middle temporal; 9, inferior temporal; 10, 11, 12, occipital lobe; *E. F.* external perpendicular fissure; *F. S.* Fissure of Sylvius; *F. R.* Fissure of Rolando. (After Gratiolet.)

lobe 2 and 3. They are very generally present in human brains, and in highly convoluted brains they often are especially highly convoluted also. Their classificatory importance I should not rank so highly, partly because one or other of them, or both, may be possessed by apes, and the mass lettered α and β may come out to the surface in them, forming, it is true, an hourglass-shaped lobe, not a sub-quadrate one, as in man, but coming up to the surface for all that, partly because they are not invariably present in such full development as M. Gratiolet's words would imply, and partly because they are, in a morphological point of view, tertiary convolutions, latest to be developed, and most liable to variation (Reichert, 'Gehirn,' p. 89, ii. Abtheilung). The history of these convolutions amongst certain of the lower apes becomes exceedingly instructive. The arrangement and relative development of them differ most widely in two of the commonest American monkeys, which are so closely related as to have been confounded together by certain zoologists. I mean the Brown Sagow, or Weeper Monkey (*Cebus apella*), and the *Cebus capucinus*, Fatuellus, or Horned Monkey. Will anybody pretend that any difference can be detected in the psychical phenomena, the mental manifestations, of these creatures, at all in correspondence or concomitant variation with their difference of cerebral conformation? Why Linnæus named the *Cebus capucinus* '*Cebus fatuellus*,' I know not; if it were really for fatuity, that fatuity existed in connexion with a brain which, so far as I can see, was superior to that of its rival, the *Cebus apella*.

Lastly, the fissure in which these conditions exist, either filling it up level with either edge, or winding down into its depths and up its declivities, has an internal aspect, and this internal aspect may present the chasm appearance, or it may be filled up. In man it is always a chasm, it is never filled up. Two convolutions, the internal connecting bridges, are as invariably, and more invariably, if so I may say, atrophied and concealed in this place in man, than the external are in apes. In many of the monkeys, and they too not often highest in their class, this internal chasm is filled up. In the diagrams these facts are shown, though I must own somewhat indistinctly. In the monkey's brain (Fig. 1 b, I.) this internal fissure is irregularly seamed, and not smooth as in the human brain. Now the irregular seaming is due to the transverse section of an

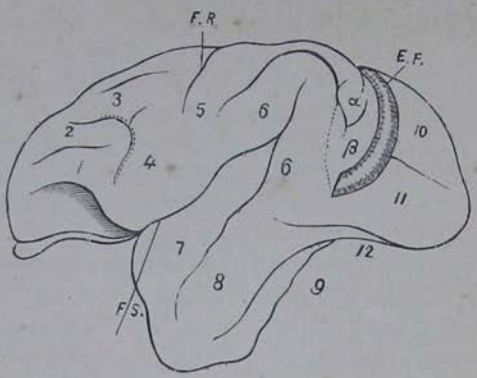

FIG. 7.—The same Hemisphere, with the lips of the external perpendicular fissure *E. F.* separated so as to show the bridging convolutions *α* and *β* lying within it.

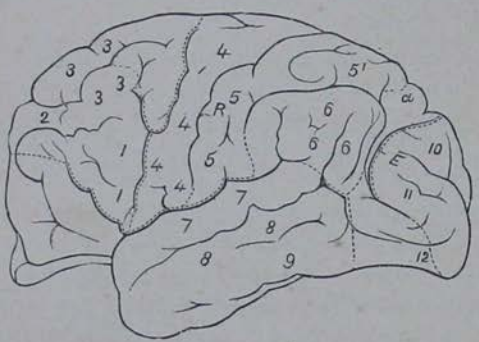

FIG. 4 *a*.—Left Cerebral Hemisphere of Orang Utang, *Simia morio*, lettered and numbered as the preceding figures. The superior bridging convolution *α* is seen to come to the surface at the internal end of the external perpendicular fissure *E*.

internal bridging convolution, the entire absence of which from the human fissure leaves it a clear void. The clear open fissure in the diagram (Fig. 1 b, F. H.) is not the internal perpendicular but the hippocampal fissure, and its large size corresponds to the large hippocampus, not to the large internal occipital furrow of the human brain.

Brain then for brain, we may say that the human brain is always wanting in internal, the simious very frequently in external, convolutions for the filling up of a certain fissure which separates the occipital from the parietal lobes in either case. This fact does not at first seem to affect the typical meaning, or classificatory value, or serial importance of the convolutions in question, though it is obvious that it bears with considerable force upon their physiological. But their serial value also is affected when we find that amongst the apes, the *Ateles belzebuth* (the spider monkey) alone of all those figured by M. Gratiolet, follows the human arrangement, and the human relation of these four convolutions exactly, as to the degradation of the one and the exaltation of the other set; in other words, in man and the spider monkey alone do the external connecting convolutions come fully to the surface, forming, as I have said, a quadrangular mass in man, though but an hourglass-shaped mass in the monkey. Still upon such constriction as converts a quadrangular into an hourglass-shaped mass there is little weight to be laid. Surely the Ateles is not so very much more man-like than all other monkeys upon this ground; the imperfection denoted by its name has never been belied by its manifestation of any psychical properties in correspondence with its high brain, but out of correspondence with its mutilated hand.

The small area occupied by the lobes numbered 10, 11, 12, in the human, as contrasted with that occupied by the same numbers in the simious brain, speaks of a corresponding difference in their occipital lobes; the mandrill has the largest occipital lobe (see Fig. 3 a and Fig. 5 a), man the smallest in the series. And here the doctrines of Gall may seem to coincide with the results attained by quite another method, by a far more searching and truthful analysis than his; but such coincidence is but apparent. A stunted occipital lobe is indeed a sign of elevation, whether we rise by giant strides from species to species, or by imperceptible gradations from variety

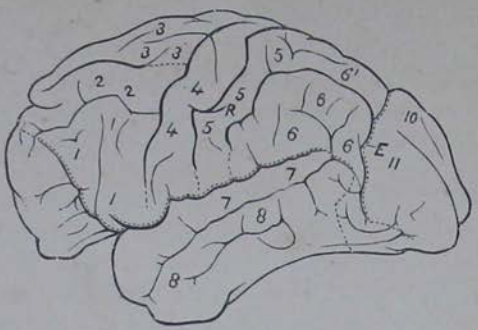

FIG. 4 *b*.—Left Cerebral Hemisphere of Chimpanzee, *Simia troglodytes*. Both bridging convolutions are concealed within the fissure *E*.

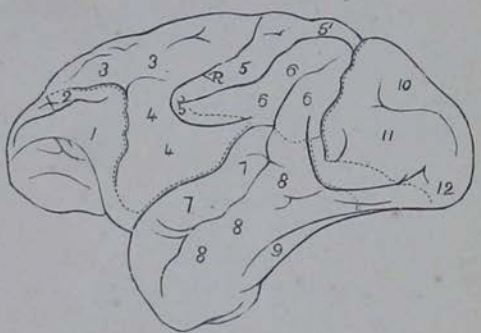

FIG. 5 *a*.—Left Cerebral Hemisphere of Mandrill, *Cynocephalus mormon*, similarly lettered and numbered. The great size of the occipital lobe is well seen.

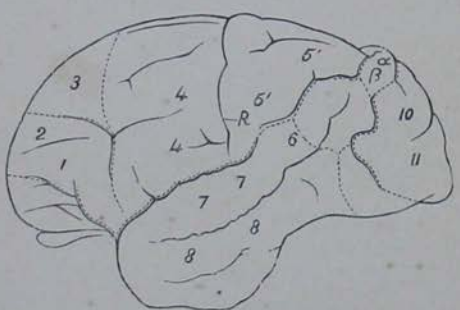

FIG. 5 *b*.—Left Cerebral Hemisphere of American Spider Monkey, *Ateles belzebuth*. Both bridging convolutions are seen to come to the surface at *α* and *β*. (After Gratiolet.)

to variety, but a stunted occipital region is not; it may contain, or it may not, in man it never does contain, occipital lobes alone. The bony case is forced out into protuberance in this region; but it is so forced out in man by the outgrowth of brain lobes which can no longer find sufficient shelter under their own proper vertebra, to use the language of mystical and exceedingly delusive anatomy; but whether these outgrowing convolutions be those lettered α and β, or those numbered 4 and 5 in our diagram, no external manifestation can tell us. It is plain that judging of the contents of any one of the four volumes of a four-volume work from the numeral emblazoned on its back is a scientific and safe method of coming to a decision as to its contents, when compared with the analogous procedure so commonly held to be legitimate, conclusive and safe, when applied to the human skull.

The convolutions numbered 1, 2, 3, correspond to the frontal, and a glance shows the enormous development they have attained in man; and a second will explain how it is that the horizontality on the reverse of the temporo-sphenoidal (numbered 8, 7) lobe stands in a direct ratio to the greater or less development of this frontal mass. It is broad, subquadrate in front, deep, long, complex, asymmetrical, in man; narrow, pointed in front, excavated, foreshortened, simple, symmetrical, in the apes. Divisible as it is in both alike into three stages, it is especially the uppermost which in the uppermost of mankind presents the widest difference when compared with lower organisms; but these lower organisms are, as my diagrams show (see Fig. 3b), human as well as simious, and to the believers in the doctrine of types, as commonly expounded, the words 'divisible as it is in both alike' are words of disappointment, speaking as they do to merely quantitative differences. These quantitative differences are, it may be said, incomparably wider when we measure the interval between the Hottentot Venus and the African ape; but when we measure that existing between the Hottentot Venus and the European, are the latter differences greater than those which separate such a brain as the chimpanzee's from such another as the marmoset's? Now, to these enormous differences as existing in Nature, and shown in these diagrams as existing between the African and the American ape, will any one aver he can assign concomitantly varying capacities, co-ordinately graduated amenabilities to education? I cannot but think the

answer will be in the negative; the application of such an admission to further argument I leave to suggest itself.

The two cerebral hemispheres, with the internal and external anatomy of which we have so long been dealing, might well bear some other name than hemisphere, for, according to results of experiments performed pathologically, for us, either by accident or disease, they are not so much parts of one whole as two organs mutually supplementing each other's meanings, in the same manner as any of the numerous sets of paired organs in our bi-laterally symmetrical bodies. Still, as '*vis unita fortior*,' there is an apparatus in the brain for enabling the two distinct organs which its hemispheres, or rather ovoids, make up, really to act as if they were halves of one whole. This apparatus consists of various longitudinal and transverse connecting bars and floors, between what would be in the adult animal, as in lower and developing organisms, easily divaricable, albeit apposed masses. The most important of these, in a physiological point of view, is the corpus callosum. It roofs over the ventricles; it is continuous with the fibres of the now familiar hippocampus minor; it binds together both the ovoids during life, as it prevents them utterly falling apart after death. (See Figs. 1 a, 1 b, 2.) It is all but, if not entirely, fibrous, inter-nunciant; it transmits; it cannot originate; its increase of bulk may be supposed to depend considerably upon increase of use, for in the child it is but one-half (or less) the length of what it is in the adult, increasing, it may be, from as little as $1\frac{3}{5}$ to 4 inches. The relation of length in the monkey may be gathered from the diagram (Fig. 1 b). It is seen not to extend as far back as two shaded nodules; in the human brain it projects beyond. A more careful and searching examination[1] has shown that its sectional area, in relation to the ovoids it binds together, is in the ape but half of that of the same structure in the same relations in man. This, again, is but a difference of degree, but it is a real difference, albeit clearly of physiological rather than of serial importance.

Our final enquiry will be, what is the weight of the entire nerve mass contained within the ape's brain-case, and what is the weight of the human encephalon? This weight is either absolute, what the

[1] 'Nat. Hist. Review,' July, 1861, 'On the Brain of a Young Chimpanzee,' by J. Marshall, Esq., F.R.S.

weights speak of when placed in the scales opposite to the brain, or relative, as compared with the body in which the brain was lodged during life. It is obvious that an absolutely heavier brain may be relatively lighter, and *vice versa*, than another. As less weight, as it seems to me, is to be laid upon relative than upon absolute weight, it may be well to state the facts relating to relative weight first. By common consent the largest apes are always taken as subjects of this comparison. Now, the heaviest encephalon of any one of these creatures which has been put on record is the one recorded in the 'Natural History Review' (July, 1861), by Mr. Marshall, of a chimpanzee. The brain weighing 14 oz., the body 264, the proportion of the one to the other was nearly 1 : 19. Now, in a well-nourished girl of 8·8, whose dentition was further advanced than is generally the dentition of the anthropomorphous apes which die so early in our ungenial latitudes, I find their proportion given by Tiedemann ('Philosophical Transactions,' 1836), as 1 : 14·13. The proportion between brain and body in a young orang dissected by myself was 1 : 22·3. The very self-same proportion, deducting the decimals, is given by Haller, 'Elem. Physiologiae,' iv. 10, as having been found by him to be the proportion existing between the brain and body of a boy of 6 years of age. As, I believe, it has been recently shown that the average body-weight of successful candidates in certain competitive examinations is higher than those of the unsuccessful; that is, as, indeed, the popularity of the line might have led us to anticipate, that the little body lodging a mighty mind is something of a rarity, and, as with an increase of body-weight the favourable proportion of brain to body is diminished, I need not go further into this question of relative weights of body and brain.

The question of absolute weight is of more meaning, and fortunately can be despatched in fewer words. The maximum ape's weight is 14 oz.; the minimum human is, speaking roughly, 2 lb., *i.e.* 32 oz. avoirdupois.

The lowest authentic and reliable weight of a brain of a person dying in possession of mental faculties which I can find in the most recent work on the subject with which I am acquainted (Wagner, 'Vorstudien,' Göttingen, 1860) gives, from Dr. Sims, 31 oz. as the weight of a woman's brain who died at 73, with a brain at once atrophied and filled with fluid. Tiedemann's Negro

brain I have spoken of in the 'Natural History Review,' April, 1861, p. 208, as weighing but 26 oz. This weight I gave on the authority of Huschke, who speaks of it in two places as 753 grammes[1]. But Tiedemann's own weights would give this brain's weight as 29 oz. avoirdupois. And upon this 29 oz. I lay no stress, for most uncharitably I have come to suspect from Tiedemann's own history of this brain, procured for him, like the orang's, by his indefatigable son-in-law, Fohmann, that he weighed this brain after it had been deprived of much of its watery and saline constituents, by the action of alcohol. Let the facts, then, stand thus: the maximum weight of the ape's brain is 14 oz., instanced in the chimpanzee—M. Gratiolet having shown us that the gorilla's brain is smaller than the orang's—the minimum human is 31 oz.

This doubly, and more than doubly, greater weight, the doubly greater corpus callosum, that sub-quadrate lobule lettered α and β in the diagram, those complexly convoluted frontal lobes 1, 2, 3, are I believe the four great points in which the human brain asserts its superiority over that of the ape. 'Praevalet in homine cerebrum,' we say with Tiedemann ('Icon.' Cor. xxxii. p. 54). His anatomy is as much more correct than that of Bossuet or Buffon, as I cannot but say their metaphysics seem to me than his materialism.

With a few words upon the philosophical, or to speak more strictly, the anthropological bearings of the entire subject, I will conclude.

Some persons may not think it wholly clear that with our faculties, and with our data, as at present working, and as at present existing, and likely to exist, we can reasonably hope to solve the problem which in more or less definite shape has been flitting before us during this lecture. It is possible that in this question, as in so many others, there may be a state of doubt which is surer than certainty, an ignorance which is wiser than knowledge. Such hesitation may be the truest wisdom; but to the instincts of most men at all times, and of all men at certain times, a philosophy of assertion is more satisfactory than a philosophy of suspense, so that I feel myself compelled to attempt something more positive as the conclusion of the whole matter, than the advice my last two sentences hint at.

[1] 'Schädel, Hirn und Seele.' Huschke, Jena, 1854, pp. 71, 73.

To believers, then, in the Doctrine of Types, I would suggest in the way of comfort, that even if it were to be clearly proved, which however I do not say that it yet is, that the differences between man's brain and that of the apes are differences entirely of quantity, there is no reason in the nature of things why so many and such weighty differences of degree should not amount to a difference of kind. Differences of degree and differences of kind are, it is true, mutually exclusive terms in the anthropomorphic language of the schools; whether they are so also in the laboratory of Nature, we may very well doubt. In the inspection of a museum, it is but the uneducated who look at the cases and shelves, and admire them, the handiwork of the carpenter, to the neglect of the works of nature for the convenient arrangement of which they were designed. Yet educated men are constantly guilty of analogous vulgarity of thought, when they worship formulae rather than facts, and bind themselves rather than phenomena in the trammels of artificial classifications. I would express the moral of my metaphor by saying that of all idolatry, that which is paid to the *Idola Theatri* is in these days of ours the least justifiable.

With the difficulty which has been raised[1] by speaking of the sparks of understanding and flashes of ratiocination which we see every now and then flickering out in the life manifestations of the lower animals, as though they were nascent soul and nascent spirit, the metaphysician may very safely be trusted to deal. Kant and Coleridge have indeed lived in vain, if their very dullest disciple is unable to grapple with this objection.

But an anatomist may go out of his way to say to believers in the Theory of Development, that, granting the human brain to be greatly larger according to actual measurement, and greatly more perfect, according to all the analogies which other systems and structures offer us, he by no means allows as a direct consequence of this, that of the two terms of the comparison which is present always to our mind's eye, during such an investigation, soul is the second and body the first—that psychical manifestations, mental phenomena, are the result, not soul the condition, of bodily perfection. There are many facts in biology, not the least striking of which Gratiolet's analysis of the Brain Convolutions has enabled certain[2] of his disciples to discover, which go to prove that mind

[1] 'Nat. Hist. Review,' January, 1862, p. 8.

[2] Wagner, 'Vorstudien,' p. 90.

and matter, structures and functions, do not always vary concomitantly. But omitting these, let us look at the fact of the correlation which usually is to be found existing between them *secundum statum praesentem*. Which is in the condition of dependence—mind or body? which modifies, which is adapted, which is the second, which the first? I may transgress the rules of logic, but I shall not violate the laws of reason, if I hint my argument in the words of our living poet. Have we not all read of him whose mental struggles

'Had marr'd his face, and marked it ere his time[1]'?

and of the happier history of him

'Whose very face with change of heart was changed[2]'?

In what other way than the one just suggested can we read the physical results of education, operating, as it often does, upon the adult well nigh as markedly as upon the younger and more plastic? Are not all these phenomena facts in just as true a sense as any which scalpel or callipers, which weights or measures, can disclose? The creations of art reproducing, and the instinct of the million appreciating, physiognomy, speak, it is true, in plain and trivial, yet for all that, in forcible language, to the truth of the explanation at which I hint. All alike, when coldly and dispassionately viewed as concomitantly varying phenomena, lead us to hold that our higher and diviner life is not a mere result of the abundance of our convolutions. How harmony may have come to exist between them, our faculties are incompetent either to decide or to discover; but this shortcoming of man's intelligence affects neither his duties nor his hopes, neither his fears nor his aspirations.

[As regards the first and second bridging convolutions (*plis de passage*) described in both this memoir and that on the Brain of the Orang, the Editor may refer to his account of their arrangement in the brain of the Chimpanzee (Proc. Roy. Soc. Edinburgh, Feb. 1866). Of four brains in the Anatomical Museum of the University of Edinburgh, two have the parieto-occipital fissure unbridged; in one it is crossed on the left side by the first bridging convolution; whilst in one it is crossed on the right side by the first and on the left side by the second. M. Paul Broca ('L'Ordre des Primates,' Paris, 1870) refers also to a specimen, like the one last named, dissected in Paris.—EDITOR.]

[1] Tennyson, 'Idylls of the King,' 'Elaine.'
[2] Ibid. 'Enid.'

III.

NOTE ON THE PRESERVATION OF ENCEPHALA BY THE ZINC CHLORIDE.

It has long been known that zinc chloride may be used in conjunction with spirit for the preservation of encephala. Gratiolet in a note at p. 11 of his famous 'Mémoire sur les plis cérébraux de l'Homme et des Primates,' 1854, informs us that a certain Parisian modeller, by name Stahl, was in the habit of hardening brains for modelling, by placing them whilst fresh, and with the membranes adherent, for two or three days in a solution of zinc chloride marking 25° on the areometer of Gay-Lussac. Gratiolet, however, does not say that he himself treated brains in this fashion for his own purpose; if he had so treated them he would have discovered that for purposes of manipulation it is necessary to subject the brain thus acted upon to an immersion in alcohol. This Professor von Bischoff of Munich pointed out in his Memoir on 'Die Grosshirnwindungen des Menschen' ('Abhandlungen der k. bayer. Akad. der Wiss.' Cl. ii. Bd. x. Abtheil. ii. 1868, p. 401, or 'S. A.' pp. 11, 12), stating at the same time that having employed the solution of zinc chloride for twenty-four years for the preservation of subjects for dissection he had observed that the brains of subjects thus injected, and brains simply put into this solution, presented the following advantages for purposes of study. They become more plastic and tough, less liable to chapping and breaking away in flakes, than brains simply treated with alcohol; but they do require some subsequent supplementary immersion in alcohol of moderate strength to prevent the acid chloride, which at first coagulates, from softening the albuminous substances of the organ. A second, and this not an inconsiderable advantage, is attained by their allowing the pia mater to be stripped away with

much greater ease and rapidity than is the case in brains not thus treated. Especially is this the case in the brains of foetuses, in which, whilst the substance of the convolutions is softer, the amount of their vascular supply is relatively much greater than in adults.

I have little to add to these recommendations except in the way of confirmation based upon the results attained by applying this method to specimens to be preserved permanently in catalogued series. And I may say that a permanent specimen of a brain of any vertebrate animal which has been treated with zinc chloride, either injected by the umbilical vessels, as is to be done in the case of foetuses, or otherwise brought into relation with it, contrasts very usually with a brain which has been treated with alcohol alone, in having a much smoother and less grumous surface than brains treated in this latter fashion, however painstakingly their membranes may have been picked away from them. The difference may be illustrated by saying, that the surfaces of two sets of brains, thus severally treated, differ very much in the same way that the surfaces of the bones of wild and domesticated representatives of the same species differ.

But, secondly, I would say that the condition of freshness is by no means absolutely necessary for the purposes of making anatomical preparations of brains, as M. Stahl appears to have found it to be for the purpose of modelling. Having to deal with the brain of a large toper shark (*Galeus canis*), some way removed from that condition of freshness which would have rendered it safe to attempt to remove it from the skull, I treated it for some days *in situ*, firstly with zinc chloride, and subsequently with spirit. After this, it bore removal from the skull, as well as the brains of its congeners, which came into our hands in more favourable conditions, and in this matter of smoothness and clearness, and what the Germans call the 'Glanz' of its surface, it compares to considerable advantage with them (see Prep. 896, *b. e.* Anatomical Department, Oxford Univerity Museum). For the successful application, however, of Broca's method of hardening and shrinking a brain by nitric acid, for which see 'Mém. Soc. Anthrop., Paris,' ii. 1865, p. 84, into a mass which, when dried and varnished, bears handling for an indefinite period; I take this opportunity of saying that I incline to think the condition of freshness is usually

necessary. Brains, however, like other organs, vary very much in their consistence and power of taking on consistence after death, and the amount of uncertainty which attaches to this latter mode of preserving brains may perhaps be explained otherwise. Thirdly, I have observed in adult human brains, treated with Burnett's solution of zinc chloride, that the larger arteries will, if not removed sufficiently early, recoil or retract themselves as arteries in a living body will do when cut away from their peripheral ramifications, and so come to imbed themselves in the substance of the convolutions, and thereby channel and disfigure them. In this matter of the expediency of not delaying the removal of the membranes, the nitric acid method coincides with the zinc chloride. (For this, as regards the former method, see Dr. Bevan Lewis, cit. Dr. J. Crichton Browne, on General Paralysis of the Insane, 'West Riding Lunatic Asylum Medical Reports,' vol. vi. 1876, p. 203.)

In conclusion, I may draw attention to the fact that Duvernoy in his Memoir on the Nervous System of the Lamellibranchiata, published with exquisite and accurate illustrations in the 'Mémoires de l'Institut,' 1854, p. 8, tells us that he used zinc chloride for his dissections.

The specific gravity of Burnett's solution of zinc chloride is about 1·343, and it may be used undiluted for the purposes in question. The above method of preserving the brain, which we have for some years carried out in the Oxford Museum, agrees in its essential features with the first stage of the process recently described by Dr. Carlo Giacomini in a communication made to the Royal Academy of Medicine of Turin. (See Abstract in Report on recent memoirs on the Anatomy of the Brain in 'Journal of Anatomy and Physiology,' Jan. 1879.)

IV.

ON CORRELATIONS OF GROWTH, WITH A SPECIAL EXAMPLE FROM THE ANATOMY OF A PORPOISE.

PHILOSOPHERS of other countries have often taken occasion to remark, and in no complimentary terms, upon the utilitarian tendency constantly displayed by the English mind. Our everlasting seeking after hidden purposes, our infantine inquisitiveness after final causes in biological as well as other investigations, has frequently called forth contemptuous comments from foreigners who happened to be acquainted with Bacon's famous comparison of final causes to vestal virgins. But in these latter days it has come to be acknowledged, even in England, that there are many structures in normal organisms for the existence of which no teleological explanation will suffice; and it is right to say that in no other country, and in no other time than ours, have theories for the explanation of such phenomena been more clearly enunciated. Our natural hankering after hypothesis, our constitutional craving after rationales, has called into use, if not into being, the several theories of adherence to type, of complemental nutrition, of genealogical, yet modified, transmission, and of correlation of growth.

The first of these theories has won with us not a little popularity; its antique dress, striking the eye, diverted the attention from the utter incongruity which exists between Platonic mysticisms and modern science; and, appealing to our reverence for the dreams of our youth, it has lived longer, and made more converts than unassisted by the associations of the Academy it ever could have done. Even now it is fairly in the way of developing out of the larva stage of an Idolon Theatri into an Idolon Fori, a more active, elusive, albeit fragile, Imago. But a few years back, the joint empire of final and formal causes, of confederated teleological and

morphological considerations, seemed firmly established in a country delighting in compromises; the legitimacy of the one, and the prescriptive right of the other, placed them, when united, in an apparently unassailable position. The appearance of the theory of complemental nutrition in a deservedly well-known work[1] caused men to accept of a triumvirate of ruling causes. Material causes counted for something as well as final and formal; Wolff's theory could suffice not only for the rationalisation of many phenomena which Paley and Oken did explain, but also for the elucidation of some with which their philosophies were incompetent to deal. Mr. Paget's exemplifications of the law of complemental nutrition seem drawn exclusively from a class of cases of what I would call 'heterogeneous growth.' The evolution of the one structure has rendered possible the evolution of the other, by setting free some residual product which Nature in her economy has worked up into such secondary structure. The perfecting of the plumage contemporaneously with the perfecting of the sexual functions in the pairing bird is one, and may serve as a type of all, of the instances given by Mr. Paget. There is no equality in rank between the two structures, which stand to each other in this relation of complemental nutrition; the one is supported by what the other finds useless, superfluous, or even hurtful; after the production of the one the organism aims and labours, the other is but a 'nebenprodukt;' they are heterogeneous in the same sense as the food of the hound and the food of his master, and often in a yet truer sense still.

The instances of correlated growths to which I am about to refer, and which from the dissection I shall describe I hope to elucidate, differ from those classed under the head of Complemental Nutrition, in that both growths draw with equal right and to an equal extent upon the same store of nutriment. To the same stock of alimentary matters they stand in the same relation; they share and share alike either as joint consumers or joint elaborators of it. If we may coin a word from but second-hand Greek, and borrow one half of our composite from our Anglicised word 'tautologous,' we would call these growths 'tautogeneous.' As just hinted, they admit of a twofold rationale. The blood either needs, as in the case I shall

[1] 'Lectures on Surgical Pathology,' vol. i. lect. ii, 1853, by Mr. Paget, now Sir James Paget.

proceed to detail, an excess of some material, or it possesses some material in excess over its requirements; in either case 'tautogeneous' growths spring up, in the one case to elaborate, in the other to consume, that excess of material. The history of pathological tumours is but an illustration of the latter of these divisions. The severity of our struggle for existence has called into being so rigid a law of parsimony, as to render it difficult to give illustrations of this class of tautogeneous growths from physiological nutrition. But though difficult, it is not impossible. I proceed to illustrate the former of these two divisions by an account of certain structures observed by me in a recent dissection of a young porpoise. The animal was a young *Phocaena communis*, but it had attained at least four-fifths of its full size, weighing as it did 60 lbs. and being $47\frac{1}{4}$ inches in length.

On either side the aorta, just where it became free from the diaphragm, on passing into the abdomen, two elongated bodies were to be seen, lying in close contact with the posterior part of its calibre for a length of as much as three inches. Their width was about the fourth of an inch, and this width was maintained for their entire length. Their external surface was smooth, only a little lobulated at their upper end and internal margin. They possessed a readily detachable fibro-cellular capsule. They were reddish in colour, firm to the touch, on section at first homogeneous, but subsequently showing to careful inspection numerous orifices of cut vessels, though very little fibrous stroma. Their upper ends lay behind, and in contact with the posterior half of each supra-renal capsule. This relation will show that the structures in question could not have been abnormally persistent Wolffian bodies, which indeed further particulars will yet further prove.

These structures, when examined by the microscope, were seen to be all but wholly made up of such cells as we get from the Malpighian bodies in the spleen, or indeed from the cortical part of a lymphatic gland, namely, circular nucleated cells with granular contents, of a size somewhat less than that of a red blood corpuscle.

Functionally, these structures may be regarded as identical with lymphatic glands; morphologically, I consider them different; on account, first, of their symmetrically elongated tongue-like shape, all but entirely smooth and unlobulated, and secondly, on account

of their encapsulation in an external coat of fibro-cellular tissue, and their want of such supporting elements within their parenchyma[1].

There can at all events be no doubt that they were developed from the general formative mass of blastema, which surrounds the aorta in the foetus, as described by Professor Goodsir[2]; and that therefore they were morphologically as well as physiologically to be classed with the thymus[3]. This gland, as well as the thyroid, was largely developed in this specimen, and the arrangement of the two glands coincided very exactly with the description given of them by my friend Mr. Turner[4].

The lymphatic glands generally throughout the body were largely developed; so largely, in fact, at either jaw angle, as to simulate the appearance of a large submaxillary gland. The spleen was, as has been so often described, curiously multifid.

All of these ductless, all of these lymphatic glands were richly supplied with blood vessels; all, alike and jointly, laboured at the elaboration of the constituent elements of the vast mass of this cetacean's blood. They enabled it thus to support a high standard of temperature in an excellent conducting medium, and they supplied all the calls for rich and refined aliment which a brain equalling in this case one-sixtieth of the weight of the entire body made upon the nutritive fluids. They may be taken as illustrations of 'tautogeneous growths' of the first of our two classes.

Many of Mr. Paget's instances of complemental nutrition Mr. Darwin would explain as the results[5] of hereditary transmission, with modification, and there can be little doubt that of the two hypotheses the latter will to many minds seem to suit the better with such instances as the four rudiments of nails on the fins of the manatee, or the equally rudimentary teeth in the ruminant's

[1] Though my dissection enables me to confirm the views put forth by Mr. Turner, it compels me to dissent from those anatomists who say there is nothing in the Cetacean economy to represent either the Vena Azygos or the Cowper's Glands of Human Anatomy.

[2] 'Phil. Trans.' 1846, p. 638.

[3] In the common shrew, however, two bodies are to be found, floating loosely in the abdominal cavity, but anchored each by a process of mesentery which is attached just where these bodies in the porpoise lie fixed; and that they are connected with the lymphatic, or rather with the lacteal system, an examination of a shrew, which has died whilst digesting, will leave no doubt.

[4] 'Transact. Royal Soc. Edinburgh,' vol. xxii. part ii.

[5] 'Origin of Species,' pp. 453-454, 1st edit.; pp. 486-487, 3rd edit.

inter-maxillaries, or of the representatives of the Polian vesicles in the *Arenicola*.

But many of Mr. Paget's instances cannot be brought under this head, and constituted as our minds are, we cannot but read them as he has done.

Mr. Darwin, on the other hand, himself admits[1] that there are many instances of correlated growth of which our reason can give no rationale, either as subserving ends, or as conforming to type, or as speaking of parentage, or as working up into structure what would else be waste and excretory; for which in other words it can assign neither final, nor formal, nor material cause. I would instance, in addition to those he brings forward, the correlations of growth witnessed in Morbus caeruleus betwixt a malformation of the heart and a clubbed adunque state of the finger-nails, and in Morbus Addisoni betwixt disorganised supra-renal capsules and pigmentary skin-discolouration. Unable to rationalise, we class such phenomena as these under the wide head of 'Correlations of Growth.' The very vagueness of the phrase prevents us from even momentarily deluding ourselves with the idea that it amounts to an explanation, and to more therefore than an expression of facts. It cannot be accused of striving to conceal the flimsiness of its thought by a magnificent display of archaic words, as certain exchequers would fain conceal their bankruptcy from the world by a copious issue of paper-money. Herein lies its great merit.

On a future occasion I shall consider the nature of the hybernating glands, if so they may be called, of certain hybernating and non-hybernating Insectivora and Chiroptera, and the possibility of classing them as growths tautogeneous with the highly-developed mesenteric and cervical lymphatic glands found in so many of those creatures.

And before concluding I would mention yet another class of structures, the existence of which admits of being rationalised upon yet another principle. These structures, fixed and settled in the adult organism, speak of a time when the sex was as yet unfixed and unsettled in the developing embryo, and accessory organs of either kind were, if so we may say, prepared so as to be in readiness to meet either event. The mammary glands, the Weberian organ, and the cysts of Morgagni of the adult male, the round ligament

[1] 'Origin of Species,' pp. 145, 197, 1st edit.; pp. 162, 217, 3rd edit.

and the canals of Nuck and of Gärtner of the adult female economy, may have the history of their existence thus read.

As more and more *verae causae* assert their existence and vindicate their rights, the ancient realm of Archetypal Ideas will suffer more and more serious curtailment[1]. But like all other failing empires, it too will find its advocates to speak of it as being an 'essentially conservative power:' though after short campaigns it has, once and again, had to resign some of the fairest provinces in the world of thought, its existence will still be said to be necessary for the preservation of the due 'balance of power' amongst rival biological principles.

Let us hope that in the interludes of rhetoric the logic of facts may find a moment to make itself heard. It will teach men *mundum quaerere non in microcosmo suo sed in mundo majore*, to hold of Nature that her ways are not as our ways, nor her thoughts as our thoughts. The notion of type may help man's weakness, but it by no means therefore follows that it regulates Nature's operations; it may enable us to colligate phenomena, but it may no more for that be the cause of their evolution than the mule's panniers which carry home the grapes are, by virtue of this their function, the cause of the growth of the vine.

[1] Even in Mr. Herbert Spencer's 'First Principles' we find, at p. 22, the following sentence, 'In Biology we are beginning to progress through a fusion of the Doctrine of Types with the doctrine of adaptations;' and Mr. Darwin, in the last page but one to which we have referred in his writings, speaks of 'Homology coming into play' as a really efficient physical agent.

V.

ON CERTAIN MODIFICATIONS IN THE STRUCTURE OF DIVING ANIMALS.

In this communication the Cetacea, in the class Mammalia, were contrasted with the Phocidae, and in the class Aves, the Colymbidae were contrasted with the Cinclidae, as to the degree of modification which their tegumentary, circulatory, and osseous systems had undergone in adaptation to their aquatic habits.

The skin of the seal was less specially modified than that of the whale, and the aberrations from the ordinary mammalian characters which its bones and teeth presented were in like manner less marked than those of the animals with which it was compared. The teeth in the order Seals were often irregular as regarded their number, their implantation, and their permanence in the jaw; and the epiphyses of the vertebrae were often slow to unite with the bodies. All these particularities were instances of correlation of growth existing between the skin and systems as far removed from its direct influence as the osseous and dental; and all these particularities, together with those of the systems with which they were correlated, were much more marked in the whales than in the seals. The seals were well provided with intra-hepatic venous sinuses, but their reservoirs for arterial blood were far inferior in grade of development to those of the cetacea. Little could be said as to difference in the degree of patency in the foramen ovale and ductus venosus in the two subjects of comparison, at least so far as the common seal (*Phoca vitulina*) and common porpoise (*Phocaena communis*) might serve as representatives of the two orders. To the rudiments of the foetal vena umbilicalis and ductus Botalli, in both, the same remark applied.

The stunted salivary glands of the seals seemed an approximation

to the condition of total absence which we find in carnivorous cetacea; and, but that some of the latter class possessed olfactory bulbs, a similar relation might be said to prevail between these organs also in the two orders. In both classes alike, the weight of the brain was high as compared with that of the body; in a young *Phoca vitulina* I have found it to be as 1:46, in a young *Phocaena communis* as 1:60.

The bark of the seal spoke plainly enough to its want of any such arrangement of the larynx as the whales possess; but a recent inspection of a large seal (*Pelagius monachus*) had shown it to possess an exceedingly strong sphincter muscle guarding the entrance to the respiratory passages, and it might be conjectured that the membrano-muscular pouch in connexion with the nasal passages in the *Stemmatopus cristatus* was a foreshadowing of the sac so often described in connexion with the cetacean blow-hole.

Several foetal structures were permanently retained in the cetacea. The thymus, as shown by Mr. Turner ('Edin. Roy. Soc. Trans.,' xxii. p. 2), was one of these; certain other remnants of the general formative mass of blastema which surrounds the aorta in the foetus, noticed by me in the 'Natural History Review' for Oct. 1861 [1], furnished a second example, and to these I would now add a third, in the largest remnant of a Wolffian body, or organ of Giraldès, which I have met with in the class mammalia. I may add that, in the two classes of birds which I have had to contrast, scarcely any such approximations could be traced between the two sets of structures to be compared.

The modifications in the tibiae of the birds commonly known as 'divers' (*Colymbinae*), and the large intra-hepatic venous sinuses which they, in common with the mammals just spoken of, possessed, were beautiful adaptations to the special habits of these animals; but nothing at all reminding us of these structures would be found in such a bird as the water-ouzel (*Cinclus aquaticus*). Indeed, the soft parts of this bird presented very few points of difference from those of a redwing (*Turdus iliacus*) dissected at the same time with it, except in the much greater development of the second pectoral muscle. The large size of this muscle was permanently recorded on the keel of the ouzel's sternum; and this point might perhaps have

[1] Article IV. in this volume.

enabled us, *a priori*, to predict that the bird possessed the peculiar habits which have given it its trivial name. This ridge extends the whole length of the keel in the water-ouzel; and in this point, as well as in the lesser relative depth of that process, and in the greater relative breadth of the lateral portions of the sternum, and in its more nearly circumscribed posterior emarginations, the bird in question differed from allied species of dissimilar habits.

VI.

ON THE DEVELOPMENT OF THE ENAMEL IN THE TEETH OF MAMMALS,

AS ILLUSTRATED BY THE VARIOUS STAGES OF GROWTH DEMONSTRABLE IN THE EVOLUTION OF THE FOURTH MOLAR OF A YOUNG ELEPHANT, *ELEPHAS INDICUS*, AND OF THE INCISOR TEETH IN THE FOETAL CALF, *BOS TAURUS*.

A NAKED-EYE examination of a spirit preparation of a developing molar tooth of an elephant appears to be sufficient to show that in development the dentine takes precedence of the enamel in the tooth. In such a tooth a certain number of the more anteriorly placed denticles may be seen to be formed of caps of dentine, of a yellowish colour, encrusted, for various distances from their apices downwards, with opaque white deposits of enamel. Posteriorly to the denticles of this composite character, we see a few denticles consisting of dentine alone, upon which no deposition of enamel has as yet taken place; and, most posteriorly of all, we see processes of the dentinal pulp, which, as yet, are devoid of any covering of dentine.

If, in the second place, we proceed to take note of the capsular processes in which the denticles are enclosed, we shall observe that the inner (reflected) surfaces of certain of these capsules are roughened over by deposit, in correspondence with the enamel deposit already noticed on the denticles which they surround. The deposit on the inner surface of the capsule is soft, and consists of cylindriform cells packed closely together, and forming, when their interior surface is looked down upon, a mosaic arrangement by their apposition, whilst in the immediate neighbourhood of their exterior (their still attached) surface, numerous blood-vessels are seen ramifying. There can be no doubt that we have here the often-described proximal, and, as yet, but imperfectly calcified ends of the enamel-cells,

which have broken away in the preparation from the more thoroughly calcified segments constituting the enamel deposit on the denticles. It is, in fact, the layer which has been supposed to be at once the functionless 'membrana praeformativa' of Raschkow, and the functionally protective, however otherwise physiologically inert, '*cuticula dentis*,' or 'Nasmyth's membrane.'

If now, in the third place, we take a thin microscopic section of the anterior part of the lower jaw of a fœtal calf, made in a sagittal direction, so as to show several developing teeth of various ages *in situ*, we are enabled easily to recognise the representatives of the various structures visible to the naked eye in the molar tooth of the elephant, and to harmonise the apparently conflicting statements, which have been made, as to the relations held by the tissue forming the enamel prisms, on the one hand, to the stellate tissue of the non-vascular enamel organ, and, on the other, to the vascular tooth-capsule. In such a section of a tooth, in which the enamel has already begun to be deposited, we can see the factor of the enamel organ, which is made up of stellate, loosely-compacted anastomosing cells, the so-called 'spongy substance,' occupying or forming a triangular area with the apex upwards. The apex of this triangular space marks the lowest level to which the formation of enamel has advanced in its progress downwards from the summit of the tooth. Above this point, or, in other words, where the formation of the enamel has called for an abundant supply of mineral matter, the non-vascular stellate tissue has disappeared, and allowed the vessels of the tooth-capsule to come into close relation with the enamel-forming cells which draw so largely upon what they contain. Below this point the stellate tissue gradually re-assumes its original proportions, and in a section of the lateral portions of the spoon-shaped incisors of the calf it may be seen to pass completely round the calcifying dental pulp from its buccal to its lingual surface. The area occupied by this stellate tissue corresponds, of course, to the parts of the cavities of the capsular processes, which lie below the level of the enamel deposit on the denticles; the disappearance of the stellate tissue in the molar of the elephant, and the separation in that preparation of the upper part of the capsule from the depositing enamel, are alike what the Germans call *artefacta*.

Much of what has been advanced in this short paper may be found explicitly or implicitly stated in some one or other of the

numerous memoirs or treatises on the development of the teeth which have appeared of late. It is believed, however, that as yet it has not been recorded that the enamel of the elephant's molar, as also that of the mastodon's, presents the very same decussating arrangement of the inner portion of its enamel which Mr. Tomes has figured ('Phil. Trans.,' 1850, pl. xliv, xlv, xlvi), as noted by him in the Rodentia, less the Leporidae and Hystricidae. Thus the rodent affinities of the elephant, which have so often been commented upon, receive a fresh illustration.

VII.

NOTES ON THE BLOOD-CORPUSCLES OF THE TWO-TOED SLOTH, *CHOLOPUS DIDACTYLUS*, AND OF THE ELEPHANT, *ELEPHAS INDICUS*.

Mr. H. N. Moseley[1], of Exeter College, called my attention a few days ago to the appearance of nucleation which a slide of the dried blood-corpuscles of the Two-toed Sloth, *Cholopus didactylus*, presented under a quarter-of-an-inch object-glass of Powell and Lealand's. I had a short time before met with a statement in the recently-published second part of Dr. Kühne's 'Lehrbuch der Physiologischen Chemie,' p. 195[2], to the effect that only some mammals, the sloth and the camel, possessed nucleated blood-corpuscles. And this coincidence determined me to use such means as we had at our disposal for settling a point as to which all recent authorities were, as far as my knowledge went, opposed to Dr. Kühne.

The employment of a twelfth-of-an-inch object-glass, by the same makers, has convinced Mr. Moseley and myself that, though a certain number of the dried blood-corpuscles of the sloth do contain one or more nuclei more or less roughly hewn, and irregularly and eccentrically placed, still the immense majority of them possess the non-nucleated character ordinarily assigned to the mammalian red blood-cell. The larger size of the blood-cells of the two-toed sloth, the largest next to those of the elephant put on record amongst mammalian blood-cells by Mr. Gulliver[3], may in more ways than one have rendered an examination of them by a low power amenable to fallacy, and recourse to those of a higher power necessary. In

[1] Now Professor Moseley, Dr. Rolleston's successor in the Linacre Chair.

[2] 'Lehrbuch der Physiologischen Chemie,' von Dr. W. Kühne, p. 195:—'Gewiss ist es höchst auffallend dass nur das Blut der Säugethiere sich durch den Mangel dieses Bestandtheils (des Kerns) auszeichnet, dass nur einzelne (Kameel, Faulthier) unter ihnen kernhaltige Blutkörperchen besitzen.'

[3] Hewson's Works, p. 238.

the smaller corpuscles of the camel neither power enabled us to detect the presence of nuclei in the coloured blood-cells.

Bearing in mind Nasse's observations[1] as to the comparative frequency of the presence of a large colourless nucleus, or, in the place of it, of an area of fainter colouration, in the coloured blood-cells of the pregnant human subject, and also of the pregnant bitch, I examined the blood from the uterine veins of a cow which had been killed, in ignorance, as I was told, towards the end of the period of gestation. But I was unable to discover any nucleated red corpuscles in the blood from this source.

It is well known that nucleated red blood-cells have been observed in the blood of the human subject[2], of the horse[3], of the elephant[4], of the paco[5], and of the sheep[6]; but it should also be recollected that round coloured blood-cells, so small as to resemble very closely the normal mammalian blood, may be found very constantly in the blood of certain ovipara[7]. Here, as in so many other cases, the morphological value of a structural arrangement depends, not upon an invariable presence or an invariable absence, but upon the constancy of its quantitative preponderance. And upon this principle, whatever other affinities to the sauroids the sloth may be supposed to possess, the microscopy of its blood cannot be held to point in that direction. That the red blood-cell—the carrier of oxygen, and probably enough, the distributor of heat[8] generated in the body—should present such different structural characters in the two classes, *Aves* and *Mammalia*, which are both alike warm-blooded, is a fact of the greater morphological importance for that it is physiologically so hard to understand. From the purely anatomical point of view it may be allowable to suggest that the enormous relative preponderance of the lymphatic and lacteal gland system in the mammalia may account for the almost exclusive presence in their blood of the small non-nucleated red blood-cell.

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[1] Wagner's 'Handwörterbuch,' i. 90, cit. M. Edwards, 'Leçons,' i. p. 66.

[2] Nasse, l. c.; Busk, 'Quart. Journ. Mic. Soc.' 1852; translation of Kölliker's 'Handbook,' ii. p. 348, 1854.

[3] Wharton Jones, 'Phil. Trans.' for 1846, p. 73.

[4] Ibid., and Schultz, 'Müller's Archiv,' 1839, p. 252; but see Cotti, 'Zeitschrift für Wiss. Zool.,' vol. v, cit. Kölliker, 'Mikro-Anat.,' ii. 2, 583.

[5] Wharton Jones, l. c.

[6] Ibid.

[7] Funke, 'Lehrbuch der Physiologie,' 4th edition, p. 213.

[8] Beale, in Todd and Bowman's 'Physiological Anatomy,' p. 137.

Since writing the above, I have, through the kindness of T. J. Moore, Esq., of the Liverpool Museum, had the opportunity of examining the blood of an elephant, *Elephas Indicus*, which had died a week previously in Mr. Mander's Menagerie.

In this blood very many nucleated red blood-cells were visible; but in all observed, with perhaps one exception, *the coloured factor was internally placed, whilst the colourless formed the envelope.* It is, of course, impossible to explain this arrangement as being a retention in a mammal of the condition usually met with in ovipara; for in these latter creatures it is the nucleus which is colourless, whilst the parts exteriorly to it are coloured. When the elephant's blood-cells turned over in the slide, they presented much the appearance which a figure of a blastodermic vesicle does when its *area pellucida* is dumb-bell shaped, the envelope holding, in many cases, almost as favourable a relation in point of size to the nucleus, if so it may be called, as the blastodermic vesicle does to its *area pellucida*. This appearance I have noted also in the blood of the horse, of the rabbit, and of the human subject. It is different enough from that described by Dr. Roberts in the Royal Society's 'Proceedings,' March 19th, 1863, as produced in mammalian blood-cells by the action of tannin; but, on repeating his experiment, I satisfied myself that the two sets of cases had this in common, viz. that they show that the homogeneous coloured mammalian blood-cells may be separated into two parts—one colourless and the other coloured—of which the latter shall occupy the smaller area.

I am inclined to think that the elephant's blood, though not fresh, still gave better opportunities for judging of the real nature of the appearance of nucleation than dried slides, such as those of the sloth's corpuscles, could give.

[NOTE.—The Editor may refer to some observations on the blood of *Cholopus hoffmanni* (Trans. Roy. Soc. Edinb. xxvii. p. 81), in which he describes, in a proportion of the corpuscles, the central part differentiated from the peripheral part of the corpuscle by a sharp line, so as to give the appearance of a central nucleus.]

VIII.

THREE ANATOMICAL NOTES AND TWO ANATOMICAL QUERIES.

THE following points of anatomy, though of no very wide significance, are nevertheless by no means devoid of interest, and are, I believe, new:—

1. The organs of Bojanus open into the pericardial space on either side, in the floor of that space at a point between the outer end of the auricle and the visceral mass in Ostrea and Pecten. It is obvious that this orifice, which in other Lamellibranchiata is drawn out into a funnel-shaped passage, is the representative of the 'pyriform vesicle' of the nudibranchiate mollusca, for which see Hancock, 'Linnæan Society's Transactions,' xxiv. p. 511 (1864).

2. To distinguish the skull of a hare (*Lepus timidus*) from that of a rabbit (*Lepus cuniculus*), several points of difference may be employed. Perhaps the readiest, and, as I believe, the surest, is the greater complexity of the maxillo-turbinal bones in the latter animal. It is obvious that an animal living very usually in a subterranean atmosphere is advantaged by having that atmosphere warmed as much as possible before entering the lungs.

3. Two of the subungulate rodents—viz. the guinea-pig (*Cavia aperea*), as shown by Mr. Marshall ('Phil. Trans.' 1850, p. 151); and the agouti (*Dasyprocta aguti*)—resemble the ungulata proper, in having but a single *vena cava superior*. They differ from these larger quadrupeds in possessing clavicles, though, it is true, incomplete ones. *Coelogenys* also—another of the subungulate rodents—possesses clavicles. I should be much obliged to any of the readers of the 'Journal of Anatomy and Physiology' who would inform me whether *Coelogenys*, *Hydrochoerus*, and *Dolichotis* have one or two superior *cavae*, and whether the two last-named of the five *Subungulata* are really entirely devoid of clavicles.

IX.

ON THE HOMOLOGIES OF THE LOBES OF THE LIVER IN MAMMALIA.

In descriptions of the internal anatomy of rare animals, it is usually easy, even without the aid of figures, to compare the accounts given of the arrangement of their organs with the arrangement of similar structures in animals more familiar to us. To this statement the descriptions given of the lobes and lobules of a multifid liver form an exception; and the purport of this paper is to furnish the zoologist with a convenient and readily applicable system of nomenclature for the several divisions which the liver may be found to present in the mammalian series.

The umbilical vein of the foetus, preserved for us in the adult in the so-called 'suspensory ligament,' furnishes us with our first landmark. The lobe to which it is attached we may call the 'suspensory lobe;' it is very commonly, though not in the human subject, trifid,—the suspensory ligament having one lobule to its left, sub-equal with a second to its right, which is bounded in that direction by the cystic fossa where the gall-bladder exists, and this second lobule, the 'suspensory central,' having the third lobule lying upon the right, between the indentation (when it exists) for the gall-bladder and the free right edge of the entire lobe.

The 'suspensory lobe' overhangs the two other lobes into which the mammalian liver is divisible. To the left it overhangs a lobe which is very rarely if at all deeply incised or indented; this lobe we would call the 'left lobe.' The lobe which it overhangs to the right is very frequently lobulated somewhat complexly. This 'right lobe' is divisible into three secondary lobules, the 'superior right lobule,' the 'right kidney lobule,' and the 'lobulus Spigelii.' The 'superior right lobule' is frequently in relation with the pylorus, and in some animals, as the rabbit, is deeply excavated for the

lodgment of that portion of the stomach: immediately overhung itself by the right subdivision of the suspensory lobe, it again overlies the 'right kidney lobule,' which is very commonly either deeply fissured or greatly excavated for the reception of the organ after which it is named. The 'superior right lobule' and the 'right kidney lobule' are often found to be fused into one mass in animals such as the hedgehog (*Erinaceus europaeus*) and the long-eared bat (*Plecatus auritus*), in which they are usually distinct. Lastly, we have the 'lobulus Spigelii,' which (with two exceptions in the marsupial series, viz. *Phalangista vulpina* and the *Macropus giganteus*), we have found to be more directly in connexion with, and sessile upon, the 'right kidney lobule' than upon any other portion of the liver. The bile-duct and the afferent blood-vessels of the liver pass in front of the origin of this lobule. It may effloresce into two processes distally and to the left, one of which may pass before and the other behind the cardiac end of the stomach, as in *Mus decumanus;* or it may give off a process near its origin and towards the right, which may interpose itself between the 'right kidney lobule' and the 'superior right lobule,' as in the shrew (*Sorex vulgaris*). In the nomenclature suggested by M. Duvernoy ('Ann. des Sciences Naturelles,' sér. ii. tom. iv), the left division of the suspensory lobe is named 'lobe principal gauche,' but its diminished proportions, as compared with those of the 'left lobe' in some of the Insectivora and lower Quadrumana, incline us to consider it as wholly lost in such livers as those of man and the ruminants, and to assign it, when it does exist, to the 'suspensory lobe.' Without, however, positively pronouncing upon its homology, convenience of description induces us to name it 'left suspensory lobule.'

It is proposed, then, to speak of the liver as divisible into three principal lobes, two of which frequently admit of further subdivision —at the most, however, into not more than three lobules each:—

The 'left lobe.'

The 'suspensory lobe,' which may be divided into
- a left suspensory lobule,
- a central suspensory lobule,
- a right suspensory lobule.

The 'right lobe,' which may be divided into
- a superior right lobule,
- a right kidney lobule,
- a lobulus Spigelii.

X.

ON THE PLACENTAL STRUCTURES OF THE TENREC (*CENTETES ECAUDATUS*) AND THOSE OF CERTAIN OTHER MAMMALIA; WITH REMARKS ON THE VALUE OF THE PLACENTAL SYSTEM OF CLASSIFICATION.

Having, through the kindness of Alfred Newton, Esq., F.Z.S., come into possession of a female tenrec (*Centetes ecaudatus*), I propose to lay before the Society a description of its generative organs, and of certain foetal structures which were found in connexion with them. To this I shall append descriptions of the homologous structures in several other mammalia, comparing them *inter se*, as well as with what I believe will prove to be the unique modifications of the placenta in the tenrec; and throughout the paper I shall keep in view the bearing which the facts detailed may have upon the morphological value of differences in the structure of the placenta.

1. Female Generative Organs.

The urethro-sexual and anal outlets open within a single orifice, on either side of which there is a saucer-shaped depression, such as exists within the rabbit, underlain by a cluster of all but sessile glands, with which racemose anal glands, possessing excretory ducts converging to one common pedicle, co-exist. The urethro-sexual canal is seven-eighths of an inch in length; its walls are smooth internally, and it receives on either side the duct of a Duvernoy gland. The vagina is divisible into two portions, the lower part of the tube being smooth and patent internally, whilst the upper has its canal more or less perfectly obliterated by the interlocking of inwardly growing transverse processes of its

walls. The lower part of the vagina is one inch in length; the upper is one inch and an eighth. The interlocking processes developed from the walls of the upper part leave a pervious passage from below upward for about half the length of this part of the tube; the uppermost half, however, is entirely blocked up by the formation of complete transverse septa. Upon one of these, at a distance of three-eighths of an inch from the commencement of the uterine cornua, an *os tincae* like projection a quarter of an inch long, but ending blindly, is developed. Its presence may make it doubtful whether the partition of the sexual canal, with the interlocking processes developed upon it, does not correspond to parts both of vagina and of corpus uteri. Somewhat similar processes are figured by C. G. Carus[1] in the Kinkajou (*Cercoleptes caudivolvulus*) in the vagina alone, the corpus uteri having been left undissected in the preparation there drawn; and Leuckart speaks[2] of similar outgrowths being developed in the vagina of the Banxring (*Cladobates*, sp.?) during pregnancy; whilst in the ordinary ruminants and Llama (*Auchenia glama*), figured by Carus, (l. c. fig. 5), they are confined to the corpus uteri. In the common pig (*Sus scrofa*) similar processes to those in the tenrec are to be seen occupying a similar situation[3].

There is in the tenrec a short corpus uteri above the closed portion of the sexual canal. Of the two cornua opening into it, the left one is three inches and a-half long, and the right four inches. In the left cornu there were contained four foetuses, and in addition to the utero-placental areae corresponding with them, there were two patches of tumid mucous membrane over and above, indicating apparently that two additional ova had been attached there and aborted. There was one similar patch in the right cornu, together with eight foetuses. In all, therefore, as many as fifteen ova had been impregnated; three had aborted, and twelve might have been brought to the birth. As many as twenty-one young ones are said to have been brought forth by the tenrec at one time: it has twenty-four mammae; but the number

[1] C. G. Carus, 'Tabulae Anatomiam Comparativam Illustrantes,' pars v. tab. viii. fig. 6, 1840.

'Vergleichende Anatomie und Physiologie,' von C. Bergmann und R. Leuckart, 1855, p. 627.

[3] The same condition obtains in the rhinoceros and in the elephant. (See 'Hunterian Catalogue,' iv. 2775, 2777 a.)

of mammae and the number of foetuses are by no means always in exact correspondence in the class Mammalia.

From the neighbourhood of the ovary a stout fibrous band passes upwards to lose itself in the peritoneum, lying exteriorly to the kidney, and in relation with the diaphragm. This structure is to be seen in most female mammalia; and a band, with homologous connexions, exists in many male mammalia, both of 'testicondous' and of other orders. It has been seen by me in the tamandua (*Myrmecophaga tetradactyla*) and in the *Pteropus*, and also in the foetus at full time of the pigtailed monkey (*Macacus nemestrinus*), and in the human subject at the age of fifteen months, in each case attached to the caput magus epididymis. It is, no doubt, the remnant of the *ligamentum diaphragmaticum*, figured by Kölliker (fig. 215, 'Entwickelungsgeschichte,' 1861), as connecting the Wolffian body and the generative gland of the early embryo with the structures in relation with the diaphragm.

There is no *ligamentum rotundum* in the tenrec; and indeed we should not expect to find such a structure in a species the male members of which have the testes permanently lodged in the position in which they are primarily developed[1]. The rudiment, however, of the *ligamentum diaphragmaticum* is often found coexisting with the *ligamentum rotundum*, as, for example, in the hedgehog (*Erinaceus europaeus*), and consequently it cannot be, as has been asserted[2], the homologue of it.

In the tenrec, the *ligamentum diaphragmaticum* is continued onwards from the region of the ovary on to the uterine cornu, constituting thus a *ligamentum ovarii* of anthropotomy. Upon the compound cord thus constituted the ovary is not quite sessile[3], but is connected with it by a short cord which meets it at right angles. The peritoneal capsule of the ovary is large and loose, opening by a small orifice into the general cavity of the peritoneum. The ovary itself has, from the small quantity of its stroma, the granulated appearance so well marked in the shrew and hedgehog.

[1] C. G. Carus, l. c., tab. ix. fig. 2.

[2] 'Phil. Trans.,' 1850, 516.

[3] The ovary of the sow is somewhat similarly pedunculate (see 'Hunterian Catalogue,' iv. 2782), and so also is that of other animals, as the rat.

2. Maternal and Foetal Structures developed in utero in connexion with the Embryos.

Owing to the state of preservation in which the specimen was when it came into my hands, the maternal and foetal structures in connexion with the chorion had, in every case but one, become self-analysed into three parts. These parts were, first, an area of tissue continuous at its periphery with the non-placental uterine mucous membrane; secondly, a lamina of membrane floating loosely, and, like the utero-placental area, perforated centrally by vascular orifices; and, thirdly, the placenta proper of a diameter of about half an inch. One ovum only retains its natural connexion with the uterine wall; but in several cases the lamina of membrane ordinarily found floating loosely remains attached to its utero-placental area. Of this area I will first speak. It is sub-circular, and bounded by a slightly raised parapet of uterine mucous membrane, with which an upgrowth of the chorion was continuous in all the ova, and remains so in one instance at present. The diameter of each utero-placental space thus bounded being about half an inch, its area is divisible into two regions—one, the outer one, being quoit-shaped and surrounding a circular central inner region. The depth of the outer ring is about half the length of the diameter of the entire area; it is clothed with a mucous membrane of pulpy appearance and corrugated more or less regularly. In being thicker, and in being corrugated, this portion of the utero-placental area contrasts with the mucous coating of non-placental portions of the uterus, the mechanical pressure and contact of the many foetuses accounting probably for the smoother and thinner character of the mucous layer in the latter portions of the organ. The central circular portion of each utero-placental area is distinguished, by its irregularly perforated and discoloured appearance, both from the ring-shaped area immediately surrounding it and from the rest of the uterine mucous coat. The membrane covering both regions in each utero-placental area is single, and does not admit of being split up into laminae; but in several cases the lamina, more commonly found floating freely, is left adhering to the utero-placental area. This lamina, when free, presents many orifices of blood-vessels, centrally; and its general structure is loose and pulpy. When adherent to the utero-placental area, it is by its

outer margin that it is attached along the line of demarcation between the outer and inner regions of each utero-placental area. In other words, the utero-placental mucous membrane seems to split at this line into two laminae, between which a watch-shaped cavity is included, and each of which is sieve-like centrally from vascular perforations.

The placenta is thinnest at its centre; at its periphery the chorion is prolonged upwards in the shape of a circular rim of a depth of a quarter of an inch. The umbilical vessels are very plainly seen to be prolonged into ramifications along this rim, and in it. The rim itself, or upgrowth, is continuous with the parapet, or down growth, of the uterine mucous membrane—an arrangement which, so far as I have been able to find, is unique.

The umbilical cords of these foetuses are long: the foetuses being about an inch and a half long, the cord is in some instances of equal length with them; and the cavity of the amnios is large—sufficiently capacious, indeed, to admit of the introduction of a second foetus. Resembling the human foetus more or less in these two points, the foetal membranes of the tenrec resemble those of the ruminants in the possession of numerous corpuscles studding the interior surface of the amnios. These corpuscles are in some cases attached to the inner surface of the amnios, but in most cases they have fallen away from it, in some cases they are filiform or even club-shaped, in most they are boat-shaped, or rather of the shape of a single valve of an ordinary bi-valve, and attached by the concave side to the amnios, whilst projecting with a smooth convex one into its cavity. And as to the naked eye, so under the miscroscope they resemble *les plaques de l'amnios chez les ruminants*, as described by Professor Claude Bernard [1]. The longer of these corpuscles were as much as two millimetres long by one broad—much the same size in fact as the similarly-placed corpuscles of the elephant described by Professor Owen [2]: many, however, were of smaller dimensions.

I could not discover any traces of yelk-sac, nor of allantois, nor of any membrane exterior to the amnios. Neither were any omphalo-mesenteric vessels detectable within the cavity of the abdomen. But the anastomosis between the veins of the abdominal

[1] Brown-Séquard, 'Journal de Physiologie,' vol. ii. p. 34, 1859.
[2] 'Phil. Trans.,' 1857, p. 348.

wall and the umbilical vein, which is not rare in mammalia[1], was very plainly demonstrable.

The placenta proper has assumed the 'flocculent' appearance which prolonged maceration, whether in weak spirits or in any other such menstruum, will confer on any placenta, however 'cellulo vascular' or 'spongy,' in the normal condition. Still to the apices of its villus-bearing trees, shreds of the lamina are in several instances left adhering, especially in the angle between the chorionic upgrowth and the uterine aspect of the placenta. The layer of tissue adherent to the utero-placental area possessed histological characters quite distinct from those of the muscular coat it overlay. The circular muscular coat is easily separable from the longitudinal.

The lamina of tissue intermediate between the placenta and the utero-placental area I would propose (without any reference to the etymological meaning of the word 'serotina,' or to the now exploded theory which the word was intended to bring before the mind) to call '*deciduous serotina*;' the utero-placental mucous area I would call '*non-deciduous serotina*;' and the spongy structure made up of villi and umbilical vessels, and, in all placental mammals (except Cetacea, Artiodactyles, and Perissodactyles, and possibly Bruta), of more or less maternal structure inextricably intermixed as well, I would call 'placenta.' The word 'after-birth' includes 'placenta' and 'deciduous serotina,' both usually, though not invariably, coming away together.

Owing to errors of observation, the name 'decidua serotina' has been applied to the structure I would call 'non-deciduous serotina,' as well as to that to which Dr. Priestley[2], like myself, would limit it. It is called 'parietal decidua' by Professor Goodsir[3], and 'caduque utéro-placentaire' by M. Robin[4]. And in an account of it given by Professor Kölliker, I find him speaking of it in the human subject as 'eine zusammenhängende Haut wenn er gut erhalten ist[5].' It is sometimes called 'placenta materna;' but this phrase is applied to the maternal element of the 'placenta' also,

[1] Rathke and Coste, cit. Kölliker, 'Entwickelungsgeschichte,' p. 420.

[2] 'On the Development of the Gravid Uterus,' pp. 22 and 48, 1860.

[3] 'Anatomical and Pathological Observations,' 1845, p. 60, pl. 3, fig. 6.

[4] 'Mém. Acad. Imp. Méd. Paris,' 1861, tom. xxvi. pp. 131 and 141, where there is a disquisition on its histology. See also Cazeau, 'Traité des Accouchements,' 1856, pp. 192 and 202.

[5] l. c. pp. 145 and 158.

and the adoption of it would consequently cause confusion. That the utero-placental area is, after parturition, covered by a layer of mucous tissue, and that the muscular coat is not laid bare at that period, but protected by a more or less consistent and coherent coating, to which I would affix the name of 'non-deciduous serotina,' was clearly shown, in the year 1853, by Dr. Matthews Duncan[1], and has been subsequently confirmed by Drs. Chisholm and Priestley[2] in Great Britain and by M. Robin in France.

This is not the place for histological and pathological details, such as will be found in the literature to which I have just referred; but, from a zoological point of view, it may be remarked that the fact of the non-regeneration of the uterine cotyledons of the ruminant, after accidental separation of them from the uterine wall, lends the strongest confirmation to Dr. Matthews Duncan's views. It has been most satisfactorily shown[3] that, after such an occurrence, the place of the lost cotyledon is occupied not by fresh mucous membrane, but merely by a white cicatrix.

I will now proceed to contrast and compare the foetal and maternal structures in connexion with the placenta of certain other mammals with their homologues already described in the tenrec.

Insectivora and Chiroptera.

In the hedgehog (*Erinaceus europaeus*), at a time when the foetus is about one-third the size of that of the foetal tenrec here described, and the yelk-sac is as large as the amniotic, the non-deciduous serotina is separable as a perfectly distinct and coherent coat from the circular muscular coat which it overlies; the deciduous serotina is a very thick mass, bell-shaped, with its convex end attached to the non-placental mucous membrane by a thin peripheral parapet, within which vessels and cellular tissue connect it with the utero-placental area. Exteriorly to the attachment of the delicate parapet of non-placental mucous membrane, the external surface of the deciduous serotina becomes smooth, and it may here take the name of 'decidua reflexa,' whilst its internal surface, in apposition with the ovum, remains rough and flocculent.

[1] 'Edinburgh Monthly Med. Journ.,' Sept. 1853. See also 'Medico-Chirurgical Review,' Oct. 1853; 'Edinburgh Monthly Med. Journ.,' Dec. 1857, Feb. 1858; Obstetrical Society's Trans., vol. iv, April 1859, April 1862.

[2] 'Edinburgh Monthly Med. Journal,' Sept. 1854; *ibid.* Jan. 1857.

[3] M. Goubaux, cit. Colin, 'Physiologie Comparée,' vol. ii. p. 612.

The prolongation of decidua serotina, or, in other words, the decidua reflexa, does not entirely encapsulate the ovum, as we shall see that it does in certain rodents, but falls short of doing so by an interval homologous with the non-vascular umbilicus-like spot observable in the decidua reflexa of the human subject[1]. The entire structure inter-utero-placentally and extra-ovularly placed is bell-shaped, as compared with its wafer-shaped homologue in the tenrec, or its closed sac-like homologue in the early embryo of the rat. The decidua reflexa is sometimes spoken of as being an outgrowth of the decidua serotina[2], sometimes as being continuous rather with the decidua vera in the human subject[3]. What is of importance to bear in mind is, that the non-placental mucous membrane becomes continuous at the periphery of the placental area with both non-deciduous and deciduous serotina; and that from the point of its junction with this latter structure a more or less extensive envelope grows outwards over the chorion to which the name 'decidua reflexa' is given. 'The placenta at this period in the hedgehog is a much smaller structure than the deciduous serotina it underlies; it is itself underlain by a purse-shaped allantois like that of the rabbit, which moors the amniotic sac and the foetus it contains to one pole, whilst the yelk-sac moors it to the other pole of the chorion. As in the early foetus of the dog, so in that of the hedgehog at this period, it is possible by maceration to separate entirely, or nearly so, the foetal villi growing on the allantoic area of the chorion from the maternal elements, which shortly after become inextricably interfused with them to form the 'placenta.'

In a shrew (*Sorex* sp.?) the foetus being at an early stage of development, and only three-eighths of an inch long, the deciduous serotina was, as in the hedgehog, about three times the size of the placenta proper. I did not satisfy myself that it was prolonged into a decidua reflexa; that it was so is rendered improbable by the fact that the other membranes were drawn out at either end into slender tubular processes of an eighth of an inch in length, beyond the sub-globular space occupied in the uterine cornu by the foetus. Its structure was coarsely columnar; that of the placenta presented a villous appearance. The placentae were attached to the free border of the uterine cornu.

[1] Kölliker, l. c. pp. 178 and 181. [2] Ibid. p. 142. [3] Robin, l. c. p. 131.

Of the foetus (now unfortunately lost) of a vampire (*Phyllostoma hastatum*) I have the following note:—'The ovum was five-eighths of an inch long. There was a considerable, if not complete, decidua reflexa. Next to the decidua reflexa came the chorion, to which, as in the rodents, an omphalo-mesenteric artery went.' In the uterus of this bat (which I still possess) the non-deciduous serotina is, as in the Insectivora, separable from the circular, and this again from the muscular coat.

Neither in the shrew nor in the vampire have I any note of the umbilical vesicle. In the foetus of the mole, however, and *Pteropus* I have observed it to be present and large. Before passing on to a comparison of the tenrec's placental structures with those of other orders of Mammalia, it may be well to enumerate the points in which they differ from those of the, perhaps, most nearly-allied orders, Chiroptera, as well as from those of other Insectivora. These points of difference, then, are the absence of a yelk-sac, of the allantois as a distinct sac, and of any membrane, either decidual or chorionic, on the exterior of the amnios. The upgrowth of the chorion in the tenrec, its attachment to the periphery of the utero-placental area, and the division of this area into two regions are points peculiar to this creature. Aberrant thus in its placenta, it is aberrant from those nearest of kin to it in several other peculiarities pointing towards marsupial affinities. Of these it may suffice to mention the involution of its lower jaw angle, and the reception of its lower canine into a fossa in the upper jaw.

Carnivora.

A bull-bitch (*Canis familiaris*) which had been impregnated, it was believed, by a dog of much larger size, was delivered, with artificial help, of one of two foetuses at full time. The other foetus was retained in the left uterine cornu, the life of the mother (the vagina having been ruptured) having come to an end after the birth of the first. The uterus and vagina were brought to me, together with their contents, by Dr. Tuckwell, and I am thus enabled to give the following account of the state of the after-birth, and of the uterine walls of the bitch after parturition. In the right cornu, whence the foetus which had been expelled came, the mucous membrane was much corrugated transversely to the long axis of the tube. The zone to which the foetus had been attached

was recognisable by its pale colour, a red injection which had been thrown into the vessels having given a florid tinge to the non-placental mucous coat on either side of it, but having left it of a greyish hue, and by its roughened surface irregular with depending broken ends of vessels and with processes of membrane. It was bounded also on either side by an upstanding parapet.

The same description will apply to the mucous coat of the other cornu, with the exception that in it, owing to the retention of the foetus, no corrugation was observable. On examining the mucous coat of the uterus, it was found to be perfectly continuous over the placental area, to be thicker over that zone and more opaque, and to resist disruption at the lines of junction with the non-placental portions of the coat with the greatest tenacity; and, as in the hedgehog and in the vampire (*Phyllostoma hastata*), the mucous coat of the placental area, or persistent serotina, was readily detachable, as a distinct and coherent layer, from the circular muscular coat, and this again from the longitudinal. Examined with the microscope, the utero-placental zone was found to contain abundance of tubular glands, as was also the homologous layer in the uterus of a cat at full time. The membranes of the undischarged foetus had been ruptured, and the placental zone broken across. The uterine surface was rough and shreddy; but no distinct deciduous serotina could be raised from its surface (as there can be from that of the cat at full time in a continuous ring-like sheet). Of the absence of the decidua serotina in the foetal membranes of the dog at full time both Bojanus[1] and Von Baer[2] were aware, though neither of them states that it is present at the same time in the cat. If we look, however, at the uterine surface of the placenta of the dog at full time, we shall see upon it shreds of membrane which, on floating the structure out under water, are observed to form a more or less regular polygonal reticulation. This network of upstanding laminae is the remnant of what was a separable membrane at earlier periods. This will appear the more clearly from a description of the placenta, deciduous, and non-deciduous serotina of the foetal dog at about a month of intra-uterine life.

The non-deciduous serotina is then distinctly visible as a villous

[1] 'Nova Acta,' tom. x. p. 143, 1820.

[2] 'Entwickelungsgeschichte,' ii. p. 242, 1837.

coating on the utero-placental zone. Bojanus (l. c. p. 143) speaks of it in comparison with the non-placental mucous membrane, as 'crassiorem, floccosam, leviter spongiosam, et cellulis distinctam hiantibus ubi primum foetus suis velamentis ab utero distrahitur.' Next to it we find a membrane separate alike from placenta below and non-deciduous serotina exteriorly, presenting the appearance of a circular honeycomb work, the depth of the more or less regularly polygonal cells being from the fifth to the eighth of an inch in depth, and of about the same diameter. This membrane readily peels away from the placenta proper, at all events from a specimen which has been for some time in spirit; and the surface of this latter envelope is now seen to be also obscurely mapped out into polygonal spaces. These spaces, however, are not empty, as are the honeycomb membranes just described, but their periphery is filled up with cellular elements belonging to the maternal organism, whilst in the centre of each is to be seen the summit of the mushroom-shaped upgrowths from the chorion. These two elements may, as already remarked in the case of the hedgehog, be separated from each other with some little trouble[1]; at a later period they not only become inextricably fused with each other, but, growing upward and into the honeycomb layer of decidua serotina, they cohere inextricably with it also, and bring it away with them at parturition, as already described. It is perhaps remarkable that the decidua serotina should retain its distinctness in the cat; its alveolar character, however, is not of the same coarseness as that of the homologous membrane in the dog, and the greater relative abundance of all the other elements, and the smaller consequent size of the honeycomb vacuoles, may account for the maintenance by it of an independent existence up to the time of parturition. It exists, however, in the cat at full time rather as a separable than as a coherent layer. In the dog it is neither coherent nor separable from the placenta[2].

It is difficult to see how, with the honeycomb-like decidua serotina of the foetal dog before one, placed in relation with the mucous membrane of the unimpregnated and unenlarged uterus

[1] Bischoff, 'Hunde Ei,' p. 114.

[2] It would seem from Barkow's description of the foetal membranes of a seal (*Phoca vitulina*), that the decidua serotina possesses both these characters in that animal (Zootomische Bemerkungen, 1851, p. 7).

of the bitch as figured by Dr. Sharpey[1], it is possible to cast the doubt upon that observer's views which M. Robin has done[2]. It is obvious that when glands or follicles are arranged as closely together as in the figure referred to, all increase of their calibre must take place by means of outgrowth of interfollicular or interglandular substance, and that, admitting the facts which are incontrovertible, the contradiction of M. Robin amounts but to a dispute[3] as to the use of words. Bischoff's assertion[4], that the cotyledons of the roe (*Cervus capreolus*) are devoid of utricular glands, amounts to more than a verbal question; but as Eschricht and Von Baer had noted their absence in the similar structures of ordinary ruminants[5] many years previously, this observation has little claim to be quoted as novel.

The decidua reflexa can be scarcely said to be present even as a mere rudiment in carnivora. The mucous secretion found exteriorly to the chorion may perhaps be considered as homologous with the distal part of what in other orders is a coherent, more or less perfectly encapsulating membrane.

I have not observed, nor do I know, that any observations have been made showing that any variations exist as to the relations or degree of development of the allantois, amnios, or umbilical vesicle within the class Carnivora.

Von Baer's words (l. c. p. 243),

'Vielleicht weicht das Ei der Sohlengänger, das ich nicht kenne in einiger Hinsicht, ab; beim Iltis ist der Gürtel des Fruchtkuchens nicht vollständig,'

refer in all probability to the description given of the placenta of the ferret by Daubenton, in the 'Histoire Naturelle,' tom. vii. 1758. 'Iltis' is ordinarily used to denote the polecat (*Mustela putorius*); but Von Baer may have thought himself justified in considering the polecat and ferret as of the same species, and using

[1] Müller's 'Physiology,' translated by Dr. Baly, p. 1575.

[2] Robin, l. c. p. 132: 'Les villosités des cotyledons ou du chorion de l'homme et des autres mammifères tels que ruminants, rongeurs, carnassiers, solipèdes, et fissipèdes, n'enforcent pas, comme on le dit, leurs subdivisions terminales dans les glandes tubuleuses de la muqueuse utérine.'

[3] See also Goodsir, 'Anat. and Path. Observations,' 1845, p. 58; and Henle, 'Handbuch der Eingeweidelehre,' 1862, p. 462.

[4] 'Entwickelungsgeschichte des Rehes,' 1854, p. 22. fig. 43; cit. Kölliker, l.c. p. 170.

[5] Von Baer, 'Gefässverbindung,' p. 16; Eschricht, 'De Organis,' p. 36.

the term 'Iltis' as an equivalent for *Mustela furo*. Breschet[1], however, is in no way justified in substituting for 'le furet putois' the words '*la belette Mustela*;' and Daubenton's words, which we append, will show that he is scarcely justified in speaking of this creature as furnishing an instance of a double placenta, such as that which we find in the Old World Simiadae (220):—

'Chaque fœtus avait deux placentas ronds, posés sur une zone circulaire qui embrassait le fœtus sur le milieu du corps, comme le placentas du Chien et de la Fouine. Les placentas du Furet avaient chacun environ neuf a dix lignes de diamètre et une ligne d'épaisseur dans le milieu. Leur face extérieure était grisâtre, et l'intérieure avait une couleur rougeâtre. Ils n'etaient éloignés l'un de l'autre que d'une ligne par l'un des côtés et d'un pouce par l'autre côté; *ce dernier intervalle était rempli par une sorte de placenta, car la substance qui s'y trouvait était beaucoup plus épaisse que celle du chorion et celle de l'amnios.*'

Rodentia.

The following history will show that in the rat, and probably in all other rodents, the three structures which we have called placenta, deciduous serotina, and non-deciduous serotina are as distinct from each other as they are either in the cat or in the tenrec. A female rat (*Mus decumanus*) was killed after giving birth to nine foetuses. Of these, three had been partly devoured by the mother to the extent of one-third or so of their whole bodies, beginning in two cases from the head, and in the third from the tail. The stomach of the mother was found to contain, besides the food furnished to her and the portions of the foetuses just specified, the placentas or a great number of the placentas which had been in connexion with the nine foetuses. Some of these placentas had upon the convex surface a cap of pulpy decidua serotina with a thickened border; in others this cap was removed, and the placenta, from exposure to the macerating action of the digestive juice, had its villi hanging free, and presenting an arborescent appearance. Portions of decidua serotina were found in the stomach lying loose by themselves. Some of the placentae had cords of about an inch in length in connexion with them.

Along one uterine cornu there were found six, and along the other were found three globular masses forming hernial protrusions either into or by the side of the mesometrium, and marking the places of the attachment of the nine foetuses. The cavity of the

[1] 'Mémoires de l'Institut,' tom. xix. p. 457.

uterine tube was covered with a corrugated mucous membrane: at its mesometrial border a funnel-shaped depression, also covered with this corrugated mucous membrane, led down to the hernial protrusion, or globular dilatation, which was formed by the non-deciduous serotina and the circular muscular coat with which the utero-placental mucous membrane was more intimately connected in the rodents than in any of the three orders we have as yet spoken of, and in the interstices of which much mucous tissue was contained. A projecting process of corrugated non-placental membrane marked the line where a lamina of this tissue passed to be connected with the convex surface of the deciduous serotina, about an eighth of an inch from its free edge, i. e. the thickened peripheral rim already spoken of. The non-deciduous serotina resembled the homologous structure in the human uterus in histological characters, but, so far as the naked eye is concerned, it differed widely from it, inasmuch as the deciduous serotina in the contracted human uterus formed a more or less elevated mass projecting into the cavity of the uterus, and not a laterally appended diverticular mass as in the rat. It is interesting to remark that the non-deciduous serotina in man does form a mass of such size as to have caused it to be mistaken[1] for a morbidly adherent placenta —an error involving serious consequences, but not likely to be committed by persons who by actual inspections, such as the one here recorded, of the changes undergone by the homologous structures in lower animals have vividly present to their mind the fact, which is indeed enucleable *a priori*, that the non-deciduous serotina of an emptied and contracting uterus must have different positions, relations, and proportions from those which it occupied when spread over the utero-placental area of a gravid and yet distended organ[2].

[1] Cazeau, 'Traité des Accouchements,' 1856, p. 500.

[2] The following words from M. Robin's Memoir (p. 137) are so important in themselves, and besides this they furnish such a valuable explanation of an appearance left unexplained in M. Coste's valuable 'Histoire du Développement des Corps Organisées,' that I herewith append them: 'Enfin, la portion *utero-placentaire* de la muqueuse utérine qui n'est pas entraînée par le placenta lors de l'accouchement n'est jamais *caduque*, et c'est à tort qu'on lui donne ce nom, en ajoutant comme épithète les adjectifs *serotine*, *intérutéro-placentaire*, etc. Elle persiste toujours, et ne fait que diminuer peu-à-peu d'épaisseur jusqu'à ce que son niveau ait atteint celui de la muqueuse qui de régénère. Il est toutefois des femmes chez lesquelles la muqueuse reste, pendant plusieurs années après l'accouchement, plus

A person who, like myself, is not always able to compare the specimens in the Hunterian Collection with the descriptions given of them in the Catalogues which are accessible at a distance from London, would from the description of Prep. 3466, vol. v. Physiological Series, be led to suppose, like myself, that the condition of parts there described is the same as that which I saw in the rat, and not that represented in fig. 1. tab. 8 of C. G. Carus's 'Tabulae Anatomiam Comparativam Illustrantes.' I have, however, since the appearance in Professor Huxley's 'Elements of Comparative Anatomy' (p. 107) of a sketch of the principal points of this paper, satisfied myself by an examination of the specimen No. 3466, Hunterian Museum, that I was wrong in supposing the preparation to have been wrongly described as 'a rat's uterus at an early stage of impregnation.' Preparation No. 3466 is, beyond doubt, a preparation of an organ in much the same condition as the organ figured by C. G. Carus in the plate just referred to. But I submit that the words which follow those which I have just quoted from the Hunterian Catalogue, viz. 'each of the embryos is contained in a special dilatation appended to the side of the uterine tube,' do not apply to the structures in that preparation. For, firstly, what is spoken of as a 'special dilatation appended to the side of the uterine tube' is in reality a conical projection with its wall curving continuously with those of the uterine tube, and not forming segments of another circle. And, what is of more consequence, the embryos are contained in the uterine tube, and what is contained in the misnamed 'special dilatation appended' to it is merely serotinae and placenta. The embryo of the rat, when only a line in length, is contained in the uterine tube, and together with its envelopes, causes the calibre of that tube to bulge outwards on both sides between its meso-

épaisse et plus saillante dans cet endroit qu'ailleurs.' M. Robin says, in a note of a previous paper of his, treating of this point: 'J'admettais donc, à tort, avec les autres que la serotine s'exfolie et s'élimine pendant la durée des lochies.' The appearance faithfully reproduced, but left without explanation, by M. Coste, which these views enable us to understand, will be found in pl. 1 *a*, fig. 3. In his description we read, 'Tache rougeâtre que présentait la muqueuse utérine, tout le reste de son étendue étant exsangue.' It is situated on the posterior wall, near the entrance of the left Fallopian tube of a uterus, 'd'une femme, mère de plusieurs enfants, morte empoisonné quelques jours après la menstruation.' There can be little doubt, I apprehend, that this vascular areola indicates the gradually diminishing serotina of, probably, the last pregnancy.

metrial and its free border; and a reference to Reichert's plate 6, in his recently published and most valuable essay 'Beiträge zur Entwickelungsgeschichte des Meerschweinchens,' will satisfy every one who may not have access to yet earlier specimens, that in all probability it never occupies any other position[1]. In a word, this developing uterus in the rat is moniliform, and is correctly so represented, for the most part, in Carus's plate; it is the uterus retrocedent post partum, which has 'special dilatations appended to it,' and thus presents in section a figure somewhat resembling a figure of 8 as ordinarily written, with its upper segment the larger of the two.

The foetal membranes of the rat at earlier stages are especially instructive, and without a study of them the homologies of the adult envelopes are scarcely to be unravelled. When the foetus is five-eighths of an inch long, there are two structures in connexion with it, the relations, and proportions, and even the existence of which are much masked in the more advanced stages of its development. These structures are, firstly, the decidua reflexa, which forms at this period a perfect capsule for the foetus, but which near full time is usually represented by the thickened rim at the periphery of the deciduous serotina alone, though a few shreds may still remain, and in the water-rat (*Arvicola amphibia*) often do remain, appended to this thickened rim, as if to indicate its real import. Kölliker's words (l. c. p. 154),

'Gibt es eine Stelle wo man den Uebergang von Zellen in Bindgewebsfasern deutlich demonstriren kann, so ist es hier,'

apply most accurately to this thickened rim, the remnant of decidua reflexa. The second structure, seen plainly in the early, and obscured or lost in the more advanced rat-embryo, is the primitive chorion. This membrane will be seen to pass from the point of attachment of the secondary chorion to the centre of the placenta outwards, to line the internal surface of the capsule of decidua reflexa. It is somewhat strange that Bischoff, who has figured what is nothing else than this primitive chorion (fig. 59, Meerschweinchen-Ei), should have yet fallen into the error

[1] Von Baer's remarks upon this subject are much to the point: 'Alle Embryonen (mit Ausnahmen) der frühesten Zeit so liegen dass ihr Rücken in der grossen Curvatur des Fruchthalters und seiner Hörner liegt.' Entwickelungsgeschichte, ii. p. 232. See also Reichert, l. c. pp. 130 and 131.

relative[1] to it which he has done, and to which, as entailing yet another error, we shall have to revert.

In both the early and advanced embryo, the non-placental uterine mucous membrane becomes continuous with the saucer-shaped deciduous serotina on its convex aspect, about the eighth of an inch within a line corresponding with the periphery of the after-birth, or, in other words, along a line concentric with, but an eighth of an inch within the thickened band of the late embryo. The circular parapet by which the persistent and deciduous uterine structures are connected is but a slight lamina, and gives way upon very little traction. The blood vessels and cellular tissue within its periphery serve to keep the after-birth in continuity with the persistent non-deciduous serotina. Indeed, in the agouti the blood vessels form the only bond of union, and the after-birth becomes 'pedunculate,' at least if we may trust an observation put on record by Bischoff[2] as made by Dr. Franz Müller. On the other hand, the guinea-pig's deciduous serotina is connected with the uterine non-placental mucous surface by a series of tags or fimbriae, developed at its periphery, as well as with the non-deciduous serotina by an abundance of vessels. These peripheral tags are most distinctly continuous with the uterine walls, and are injectible from the uterine vessels, whence it is much to be wondered at that Bischoff (l. c. p. 42) should have spoken of them as the remnants of the perfect decidua reflexa of earlier days. These tags are to be seen in a foetal rat, in Prep. 3467, Hunterian Museum, and they are described as follows: 'The folds or processes of the lining membrane of the uterus which converge to be attached to the maternal portion of the placenta, are here shown.' Their office is described to be that of 'supporters of the embryo, and conductors of the vessels of the maternal placenta.' With this description my own of the homologous growths in the guinea-pig will be seen to agree; but I should be inclined to say that in the preparation in question there is besides the system of radiating peripheral tags, also the uterine circular parapet, usually found alone in the rat, co-existing with them, though I have not been able to satisfy myself of the co-existence of these two connecting

[1] Kölliker, l. c. pp. 160, 161, 172.

[2] 'Meerschweinchen-Ei,' p. 6; Müller, 'Wiener Zeitschrift,' 1851; Schmidt, Jahrbücher,' bd. lxi. p. 329.

media in any placenta, as that of the guinea-pig, which I have been able to manipulate. Neither have I been so fortunate as to find this system of tags in the common rat (*Mus decumanus*); and but that the homologous structures, two only in number, which are to be seen in the rabbit (*Lepus cuniculus*), are far from being invariable in their appearance, I should suggest that the foetal rat in question was of the black rat (*Mus rattus*) species.

The persistent or non-deciduous serotina in the guinea-pig is inseparable, save to the eye aided by the microscope, from the circular muscular coat.

Bischoff[1] says of the decidua serotina, that it separates from the regenerating mucous coat immediately after the separation of the placenta, and is either discharged or, as he thinks, in many cases quickly absorbed; and Reichert[2] believes that certain structures found not rarely in the uteri of pregnant guinea-pigs may be the remnants of the placenta uterina and decidua reflexa of previous pregnancies. I have no observations of my own with reference to what takes place in the natural order of things, but in the after-births of guinea-pigs killed at full time I have found the deciduous serotina in some cases so firmly cohering with the placenta and with the upgrowth of it as to make it difficult to believe that it does not occasionally come away with it in parturition, as by actual observation we know it does in the rat. Variations may occur in the case of the former animal.

The guinea-pig and rat resemble each other in having, in early stages of development, a perfect decidua, in having their chorion attached to the centre of a unilobed placenta, and in having the sac of the allantois early obliterated; and in all these points they differ from the Leporidae.

The circlet of vascular villi lying exteriorly to the placental area, and supplied exclusively by the omphalo-mesenteric system, is said by Bischoff[3] to spring up only in the latter part of foetal life. In those rodents in which, as in the Muridae, and in the guinea-pig, the chorion is attached by an apex, as it were, to the centre point of the floor of the placenta, we see, on making a transverse section of a uterine dilatation containing an advanced foetus, that a considerable interval exists on either side of the attachment of

[1] 'Meerschweinchen-Ei,' p. 44. [2] 'Beiträge,' p. 131.
[3] 'Meerschweinchen-Ei,' pp. 43 and 44.

the chorion to the after-birth, along which any matter secreted by the uterine mucous coat can pass. And it is precisely over the part of the chorion which forms one side of this triangular space that these villi spring up, according to Bischoff, in the later stages of pregnancy—at a period, that is, in which the non-vascular, non-secreting decidua reflexa is absorbed, and the secretion of the non-placental mucous membrane, whatever it may be, can be brought into relation with, and absorbed by, the foetal vessels. This appears to be a very beautiful instance of natural economy. In the Leporidae, it is true, the chorion is not attached to the centre of the placentulae, and it therefore has not that partial protection from the pressure of the uterine walls for the omphalo-mesenteric circlet of villi which the placentae of the rodents we are speaking of enjoy; but as their decidua reflexa is but a rudimentary fringe, whatever is secreted by the uterine walls can at all times come into immediate relation with the omphalo-mesenteric vessels, and be absorbed by, or interchange products with them. In no rodent that I have examined is the non-decidous serotina separable as a distinct and coherent layer from the circular muscular coat; in all rodents the placental site is on the mesometrial border, and in all also, and not merely in the rabbit[1], does the chorion receive a vascular supply from the omphalo-mesenteric as well as from the umbilical arteries. In all rodents that I have examined at the time of their birth the omphalo-mesenteric vessels were persistent. In this point they agree with the Carnivora; and in that of these vessels being supplied to the chorion, the vampire resembles them.

Simiadae.

A female pig-tailed monkey (*Macacus nemestrinus*) having died after giving birth to a foetus, and having had one of its two morbidly adherent placentae removed by artificial means before its death, the maternal vessels were injected with a red, and the foetal with a chrome-yellow injection. One of the two placentae was in its natural position; and from it a triangular slice was removed for microscopic and other examination. The deeper layers of mucous tissue which are exposed over the site of the placenta, artificially removed in the hope of saving the animal's life, are

[1] Kölliker, l. c. p. 164.

richly injected; the undisturbed superficial layer, the homologue of the human decidua vera, is of a uniform opaque white, the injection nowhere showing its colour through its smooth unbroken surface. This layer of mucous membrane abuts upon the remaining placenta a little way within its outer rim, and upon its uterine surface; whereas in the human subject it becomes continuous with it at its free edge, or even joins it a little within this on the foetal aspect. In the section of the placenta we see the arborescent upgrowths which carry the villi, and the downward processes of maternal tissue[1], more plainly than we see their homologues, at least with the naked eye, in the lower mammals of which we have been speaking. The uterine surface of the placenta is clothed by a smooth continuous membrane, from which these 'Decidua-Fortsätze' pass downwards into it. Above the placenta, a thin but coherent lamina of membrane is seen, left partly in apposition with, partly divaricated from it, and joining the decidua vera at the point where it impinges upon the after-birth. In its distinctness, and ready separability, and coherence, it resembles the deciduous serotina of the rodent; but there can be little doubt that it does not make up the whole of that layer in the macaque, but that more or less of the tissue between it and the deeper strata clothing the muscular walls, viz. the persistent non-deciduous serotina, would in the natural order of events have been deciduous likewise. More than the thin lamina may be seen to have been deciduous in the natural labour of a *Macacus rhesus*, of which the after-birth is preserved in the College of Surgeons (Hunt. Mus., Phys. Series, 3584). It is not, however, easy to say what line will exactly define the limits of deciduous from those of non-deciduous serotina. For between the muscular coat (from which in the Simiadae and Rodents, as in our own species, it is not easy to separate the mucous) and the deciduous utero-placental structures a very considerable interval exists, filled up with loose lamellae of tissue, the deeper of which, consisting of cells with large nuclei and tapering ends, have a horizontal direction, and those more directly in connexion with the deciduous layers a vertical one. In this interval a considerable

[1] These are the 'Decidua-Fortsätze' of Ecker ('Icones Physiologicae,' taf. 28. fig. 1, *df*). They are described by Kölliker ('Entwickelungsgeschichte,' p. 145), and well figured by Dr. Priestley (Lectures, p. 57. fig. 16) in the human placenta at six months, after Van der Kolk. They are much less prominent in the human placenta at full time. Cf. Kölliker, l. c. pp. 143, 177, 183.

number of large blood-vessels is also to be seen; so that we easily understand how, had the animal's life been preserved and its uterus contracted, a lamellar cake, perforated and made irregular by vermiform vessels, would, as we know it does in our own species, have come to project for a while into the cavity of the organ at the placental site. The tissue, therefore, which would have been persistent or non-deciduous serotina, differs little from the homologous layers in the human subject, except, perhaps, in being relatively somewhat more abundant. In this point (as remarked in the 'Hunterian Catalogue,' prep. 3584, and as may be seen by comparing either what I suppose to be a drawing of the placenta whence that preparation was taken, viz. Sir Everard Home's pl. 168, vol. iv. 'Comparative Anatomy,' or Breschet's fig. 2, pls. 1 and 2, and fig. 4, pls. 3 and 4, l. c., or Rudolphi's figure of a marmoset's placenta, 'Abhand. Berlin Akad.' 1828, with the description given of the human decidua serotina by Kölliker, l. c. p. 145 or p. 158, or by Priestley, l. c. p. 48) this simious decidua serotina contrasts markedly with the human. I must, however, add, that I could not note any similar difference in the placenta of a chimpanzee (*Troglodytes niger*) which I had an opportunity of seeing in the College of Surgeons. The chorion having been nearly removed when the preparation I have been describing came into my hands, I am unable to say whether the decidua reflexa retained the completeness which it and the decidua vera are figured and described by Breschet[1] as possessing. The lining membrane of the non-placental parts of the uterus was lowly vascular and smooth internally; and herein it resembles the decidua vera of the human subject. In a case where even the placentae were morbidly adherent, it will not be expected that the non-placental uterine membrane should have exfoliated. It is difficult to see, however, how the double membranes, just referred to as figured by Breschet, can have been other than deciduous; so that Kölliker[2] and Funke[3] are scarcely justified in speaking of the decidua vera, as well as the reflexa, as being exclusively human structures. Their statement and Weber's ('Zusätze,' p. 417) as to the exclusively anthropoid character of the decidua reflexa is, of course, also

[1] Pls. 1 and 2. fig. 2, pls. 3 and 4. fig. 2, p. 444 of the 'Mémoires de l'Institut,' tom. xix, 1845.

[2] l. c. p. 169.

[3] 'Lehrbuch der Physiologie,' 1858, ii. 929.

erroneous; but what we have already said is sufficient as to this envelope. I should add that Virchow[1] has shown that the decidua vera, which was supposed to be deciduous in the human species and in no other, is occasionally not deciduous at all where its caducity has been laid such stress upon, whilst in the chimpanzee the relations of the non-placental as of the placental deciduae seemed to me to be those more ordinarily described as met with in the human subject.

A third difference has been stated to exist between the human and all other placentae, namely, that the foetal capillaries were in it, and in it alone, bathed in a sinus-system, not merely apposed to vessels of similar or of somewhat similar calibre. This distinction was propounded by Weber in 1832, and indeed was known even earlier than that date[2]. The existence of this sinus-system was questioned by Eschricht[3], as previously by Von Baer[4], but without good reason. Since that time its existence has been nearly universally held to be distinctively anthropic[5]. Robin[6], however, after saying—

'La disposition de veines en forme de sinus ne se voit pas que chez la Femme,' adds, 'et peutêtre chez ceux des Singes dont l'uterus a une paroi musculeuse épaisse et rigide non intestiniforme.'

I must also confess that I am unable, in a section of the placenta of the *Macacus nemestrinus*, to recognise any such apposition to the foetal arborescent villi of maternal *vessels*, as contradistinguished from maternal *sinuses*, as the usually held views would demand. Though the injection thrown into the maternal vessels has penetrated down to the chorionic floor of the placenta, it does not seem, under the microscope, to have mapped out for itself those vascular trees which are so easily distinguishable in other placentae in the like position, and, in this placenta, in the foetal villi. It is right, however, to add that the monkey-placenta which I have been describing was injected, skilfully and successfully it is true, but still a considerable number of years before it came into my hands for examination; so that possibly less weight may be assigned to the results of a microscopic inspection of the relation of its maternal

[1] Virchow, 'Gesamm. Abhandlungen,' p. 782, 1856, cit. Dr. Matthews Duncan, 'Edin. Med. Journ.' Dec. 1857.
[2] Froriep, 'Notizen,' p. 90, no. 996.
[3] 'De Organis,' p. 28.
[4] 'Gefässverbindung,' p. 25, 1828.
[5] Hunt. Cat. 3583; Kölliker, l.c. p. 170.
[6] 'Mém. Acad. Méd. Paris,' 1861, p. 133.

and foetal blood-vascular systems than would have been due to a similar investigation of it in the recent state. I am not, however, myself inclined to think that the lapse of time has made any difference of consequence in the appearances in question. Approximations, on the other hand, to the sinus arrangement of maternal intra-placental vessels have been noticed by Eschricht (l. c. p. 24) as existing in the cat; and Kölliker (l. c. pp. 163, 170) speaks of the '*colossal capillaries*,' $\frac{1}{8}'''$ wide, of the dog's placenta, as forming, in contradistinction to the ordinary capillaries of the homologous parts in the rabbit, the ruminants, and the pig, a transition towards the arrangement which, in the previous sentence, he characterises as exclusively human[1].

It is well to put on record the fact that upon yet a fourth point of supposed difference between the simious and the human placenta considerable weight has been laid, which close examination has shown it would not bear. This point was the persistence of the umbilical vesicle; and Rudolphi[2] speaks emphatically of its supposed disappearance at the third month in the human foetus as sharply differentiating its foetal structures from those of *Mycetes*, which, in other points, it so closely coincides with. This statement looks strange by the side of such a title to a recent monograph[3] as the following: 'Das Nabelbläschen ein constantes Gebilde in den Nachgeburt des ausgetragenes Kindes' (The umbilical Vesicle a constant structure in the After-birth of the Child at full time'), or of a statement to the same effect as the heading of this paper of Dr. Schultze's, which is made by Breschet[4] in his already cited memoir.

Before leaving the subject of the simious placenta, it may be well to state that the last-named author is inclined to suspect that further investigation will show that a naked-eye difference of arrangement distinguishes, as do many other points of the like character, the Old-World from the New-World monkeys. This point of difference is the possession by the New-World of a uni-

[1] [The Editor in his memoir on the Placentation of the Apes (Phil. Trans. 1878, pp. 537, 555) has now established the presence of an intra-placental sinus-system in the ape.]

[2] 'Abhandlungen Berlin Akad. Phys. Klass.' 1828. 'Bis hierher alles also menschlich; aber nun die grösste Abweichung zwar nicht der absoluten aber der relativen Zeit nach wem man das Nabelbläschen betrachtet.'

[3] Von Dr. Bernhard Sigismund Schultze, Professor der Geburtshülfe in Jena; Leipsic, 1861.

[4] l. c. p. 470.

lobed, and by the Old-World monkeys of a bi-lobed placenta; and should Professor Breschet's anticipations prove to be correct, we should have an additional, though slight confirmation of the law which teaches us to expect to find considerable differences in structure and in habits between Old-World animals and their South-American representatives, and an additional, though slight confirmation of the general value of the placental system from a classificatory point of view. I call the confirmation it would lend to these great principles but slight, firstly, because the anthropomorphous apes, if we may judge, at least, from one of them, viz. the chimpanzee (*Troglodytes niger*), resemble the New-World monkeys, and differ from the Old-World species, so much nearer to them in other structures and in place, in possessing a uni-lobed placenta; and, secondly, because such a point as the divarication of such an organ as a placenta, which is usually a single mass, into two or more naked-eye masses, seems to me but of small morphological importance. Such an example as that of the ferret (*Mustela furo*), already detailed from Daubenton, deters one from assigning any very great value to the continuity or discontinuity of the cellulo-vascular mass, which it is not pretended has changed its relations either to allantois, to amnios, or to umbilical vesicle. The placenta of the Leporidae will not, I anticipate, be found to be uniformly bi-lobular or multi-lobular; and a reference to any work on midwifery[1] will show that very great varieties of the like nature may exist in the placenta of our own species.

It would, however, be highly interesting to have further observations made as to the placentae of the long-nosed monkey (*Semnopithecus nasicus*) amongst the lower Old-World Simiadae, and of the *Callithrix sciureus* amongst the New-World monkeys, as in specimens of their placental structures (*which were, however, in both cases alike in a bad state of preservation*) Professor Breschet[2] was unable to satisfy himself that his rule held good.

[1] Cazeau, l. c. p. 191, where a figure of a cotyledonary human placenta is given.

[2] Professor Breschet's words are (l. c. p. 461), 'S'il ne s'est glissé aucune erreur dans l'histoire du fait anatomique, il faut avouer que la loi que j'établissais de l'existence d'un double placenta dans l'œuf des Singes de l'ancien continent, et d'un seul placenta dans celui des Singes d'Amérique, n'est pas exacte ou qu'elle souffre des exceptions. Le mieux serait peutêtre d'attendre que de nouvelles observations vinssent éclaircir la question et lever tous les doutes sur le point.' The following account, therefore, which may apply, perhaps, to Professor Breschet's labours, will nevertheless, I apprehend, give an incorrect impression of what his opinions are:

The figure of the placenta of the sloth, which is given by Professor C. G. Carus in his 'Tabulae Anatomiam Comparativam Illustrantes,' pars 3, does not seem to me to be so decidedly different from even the human placenta, in its naked-eye bossy outlines, as Dr. Sharpey's account[1] of the placenta of the *Manis* shows it to be from the placenta of all the Carnivora, Rodentia, Insectivora, Chiroptera, and Simiadae which have been as yet examined. A well-injected or even a well-preserved pregnant uterus of a sloth would be most valuable, and would enable us to speak more confidently as to the extent of intimacy with which the maternal and foetal blood-vessels are connected than the figures alluded to from Professor Carus's work can do[2]. Should the placenta of the sloth be found to bring away with it (as we know placentae to the full as cotyledonary in general outline do[3]) maternal elements inextricably intermingled with its mass, the structure of the placenta of the *Manis* might perhaps be explained as being an instance of 'correlation of growth' between aberrant tegumentary and reproductive organs. This, however, is but conjecture. It is of more consequence to observe that, by Professor Huxley's examination of the placentae of the elephant and the hyrax, we are enabled to make one general description of the placentae of all the Unguiculata of Linnaeus, deducting from them, provisionally, the Edentata, and definitely *Rhinoceros* and *Didelphys*. This general proposition we cannot give better than in the words of Weber, addressed, now nearly thirty years ago, to an association of German naturalists and Physicians at Bonn[4]:—

'Die gefässreichen Zellen oder Falten oder anders gestalteten zur Verbindung vom Mutter und Frucht dienende Organe des Uterus mit den gefässreichen Zotten und

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Professor Breschet has described and figured the two separate discoid placentae in the small South-American squirrel monkey (*Callithrix sciureus*, Kuhl), in the green monkey (*Cercopithecus sabaeus*, Desm.), and in the long-nosed monkey (*Semnopithecus nasicus*). (Linn. Soc. Proc. 1857, p. 17, note.) [The Editor has shown that the placenta in the Old-World *Cynocephalus mormon* is single. 'Phil. Trans.' 1878, p. 560.]

[1] Cited by Professor Huxley, 'Lectures,' p. 112.

[2] [The Editor has since the above was published described the placenta of a two-toed sloth, *Cholopus hoffmanni* ('Trans. Roy. Soc. Edinb.' 1873, vol. xxvii), and has shown the maternal to be intimately mingled with the foetal structures.]

[3] Cazeau, l. c. p. 191.

[4] Froriep, 'Notizen,' l. c., October, 1835. Weber refers here to a memoir of his own published in 1832 in Hildebrandt's 'Anatomie,' but he appears to have had no knowledge of Von Baer's now well-known paper on the same subject and to the same purpose, bearing date 1828. See Professor Huxley's 'Lectures,' p. 92.

Falten des Eitheils so verwachsen sind dass sie bei der Geburt vom Uterus abgerissen werden.' 'The vascular cells or folds or otherwise shaped organs of the uterus from the connexion of the mother and foetus are so interblended with the vascular villi and folds of the foetal parts of the membrane, that in parturition they are torn away from the uterus.'

There are, however, it must be confessed, but few propositions which can be made of all unguiculate, or of all deciduate mammalia beyond those which the two names connote. These, however, by themselves are sufficient to justify us in retaining the binary division of Professor Weber, coinciding as it does so nearly with the class founded by Linnaeus on the peculiarities of a system so far removed from the reproductive as is the tegumentary. And to them we may add the defenceless condition in which the young of nearly all deciduate mammalia, except the elephant (and *Hyrax*?), are brought into the world, and the general, though not universal co-existence in them of multifid livers and multifid lungs with simple stomachs. The value of the placentary system of classification is much better seen when we come to the subdivisions of Weber's great class, when we see that of each of the well-established orders, Simiadae, Insectivora, Rodentia, and Carnivora, a well-established and distinct aggregation of placental characters can be predicated. Of the Chiroptera I do not speak, as I have only been able to examine a single example from this order, and that but for a short time and at a comparatively early period of development. Of the placentae of the four other orders we may say, as perhaps of the entire sets of characters belonging to each of the orders themselves, that those of the Carnivora are more distinctly marked off from each and all of the other three than is any one of the other three from any other of the three; and of these three the Insectivora possess, on the whole, a nearer affinity to the Simiadae than do the Rodents. In each case the characters are those of the placenta at or near full time.

In the *Simiadae* we find the ultimate ramifications of the umbilical vessels confined to the placenta; and in it the foetal capillaries are probably not merely apposed to similar maternal vessels, but plunged within a maternal sinus-system. The presence in them of structures known as decidua reflexa and decidua vera show that all the aëration and all the nourishment which the foetus receives comes from the single or double placenta, and not at all from the extra-placental uterine mucous membrane. The de-

ciduous serotina is ordinarily separable from the uterine surface of the placenta in a coherent sheet, whilst in the surface of the placenta, besides other maternal elements, there are the processes known as 'Decidua-Fortsätze' mixed up inextricably like them, but, unlike them, distinguishable by the naked eye.

The *Insectivora* have the umbilical vessels confined to the placenta, but their ultimate capillaries are apposed to similar maternal vessels not immersed in maternal sinuses. Their decidua reflexa is more or less incomplete. The placental site may be anywhere in the circumference of the uterine tube. The tenrec's maternal and foetal structures are exceedingly aberrant. The upgrowth of the chorion, the absence of any envelope exteriorly to the amnios, and the distinction of the utero-placental region into two areae, clothed with distinct kinds of mucous tissue, are unique points in this animal. By its amniotic corpuscles it resembles the elephant among deciduate, and several orders among the non-deciduate mammals.

In the *Rodent* placenta the ramifications of the umbilical vessels have the same relations as in the Insectivora; but the chorion is supplied with blood-vessels from the omphalo-mesenteric system in its non-placental parts, which consequently take a share in the nourishment and respiration of the foetus. The decidua reflexa is, when not rudimentary from the beginning, fragmentary at the end of gestation. The deciduous serotina is always distinct from the placenta, and separable from it (even when not separated) at parturition. The placentae are always attached to the mesometrial border of the uterine cornu.

In the *Carnivora* the umbilical ramifications spread over the entire chorion, not merely in its placental zone, absorbing nutriment consequently from, and interchanging products with, the secretions of the non-placental uterine mucous membrane. The allantois is here always a perfect sac, separating the exterior of the amnios from the interior surface of the chorion. They have no decidua reflexa properly so called. The omphalo-mesenteric vessels are to be found persistent within the cavity of the abdomen, as in the Rodents, for some time after birth; but they never reach the chorion, as in that class. There is an approximation made, by the colossal maternal capillaries of certain of this class, to the sinus-system of the Simiadae.

In therefore the deciduate mammalia, or, in other words, in those mammalia in which the foetal placenta brings away with it always certain maternal elements inextricably interfused with its mass, and very commonly certain other maternal elements also in the form of a superposed layer of deciduous serotina, we find that, by looking to the three following points—firstly, to the extent of vascularity which the chorion possesses, secondly, to sources whence this vascular supply comes, and, thirdly, to the relation which the ultimate capillary ramifications of the umbilical vessels hold to the maternal blood-vascular system—we can make four classes well established and acknowledged upon quite other principles of division, viz. the Simiadae, the Insectivora, the Rodentia, and the Carnivora.

The persistence of the allantois as a sac seems to be a variable character within the limits of single classes; but its relations to the amnios within and to the secondary chorion without appear, in this as well as in the non-deciduate division of mammals, to furnish good classificatory indications.

The development of a decidua reflexa is probably constant in the Simiadae; it is variable in extent in the Rodents and probably also in the Insectivora, and it is virtually absent in the Carnivora.

In the Rodents alone does the yelk-sac assume any physiological importance, and this it does by virtue of the omphalo-mesenteric vessels it carries, and at the cost of its sac-character. In the other classes it is found, at the end of the period of gestation, to retain this character, the structure being in a more or less atrophied condition.

The second division in Professor Weber's binary classification of Mammals corresponds, if we exclude the Edentata provisionally, and include, with perhaps more confidence, the Sirenia[1], exactly with the Ungulata and Mutica of Linnaeus, and with the Artiodactyla, and Perissodactyla, and Mutilata of Professor Owen's classification in the Linnean Society's 'Proceedings.' Of all these animals alike it may be predicated that at parturition the villi of the chorion separate themselves from the maternal structures, in which previously they were ensheathed, without bringing away

[1] [The diffused arrangement of the villi on the chorion of the Dugong has been ascertained by Paul Harting. 'Het Ei en de Placenta van Halichore Dugong,' Utrecht, 1878.—Editor.]

any of their structures, either interfered with or superposed upon them; and for the entire class the term 'non-deciduate' is proposed by Professor Huxley. The first question which arises is: What number of general propositions can we make as to the entirety of this class, to a certain similarity existing between the least mutually resembling members of which testimony is borne by the trivial names of 'sea-cow' and 'sea-camel' as applied to certain of the herbivorous, and 'Meerschwein' to certain of the carnivorous Cetacea? There is a considerable number of such propositions; but it is not always easy to say whether certain of them are not correlated, either in the way of nutrition with the large size which distinguishes this division of placenta as a whole, or in the way of function with their peculiar modes of life, and are therefore of little classificatory value. It is as functional correlations perhaps, that we should note the absence of clavicles and the faculty of self-help which the young of all non-deciduate mammals possess from their first entrance into the world; and I should incline to consider as a correlation of growth the possession of complexly convoluted brains by these animals, since in the class to which they and their deciduate allies both belong, the complexity of the convolutions varies very commonly in a direct ratio with the increase of bulk. Neither of these explanations, however, will account for the fact that in all the non-deciduate Mammalia we find one superior cava, and one only, and that in the whole class, so few of the members of which are multiparous, the uterus still retains a bifid character, its cornua greatly predominating over the corpus uteri. In antithesis to the deciduate mammals, we find in the non-deciduate a general, though not a universal co-existence of comparatively simple livers and simple lungs with complex stomachs. I am not aware that anal glands have been observed in any non-deciduate mammal. It is well known that the generative organs of both sexes in the Artiodactyles and the Cetacea proper are 'almost exactly similar[1],' only that the testicles are not external, and there are no external parts in the females of the latter order.

The great abundance of blood and the great relative abundance of blood-cells are points common to the pig and to the porpoise; and

[1] Hunter's 'Essays and Observations,' ed. Owen, vol. ii. p. 105; and 'Hunterian Catalogue,' vol. iv. 2527.

it may be remarked that the halitus evolved on opening the great cavities of each of these animals possesses a very similar odour. Upon the first of these two points, perhaps, little stress should be laid, as it may be either a result or a necessity of the mode of life of either creature; and the latter, depending entirely upon the evidence of the sense of smell, has consequently but a subjective cogency. Much greater importance should be assigned to the statement, now ordinarily made[1], to the effect that the Cetacea have no azygos veins at all, as this peculiarity would, if it really did exist, differentiate them from all other mammals whatever. But on looking at the words of Von Baer[2], upon whose authority this statement is made, and at the facts with which Von Baer's words are usually in accordance, it will be found that the vena-azygos system not only does exist in Cetacea, but actually furnishes us with an additional point of affinity between them and the large ungulate Mammalia. Von Baer's words, in the 'Bulletin de l'Académie Impériale des Sciences de St. Pétersbourg,' l. c., are:

'La veine dite impaire qui manque *excepté le bout antérieur*, et dont les sinus de la colonne vertébrale tiennent lieu.'

This anterior end, however, is a very considerable vessel; and in the 'Nova Acta' (l. c.) I find that Von Baer describes it as having a trunk as large as that of the vena cava superior, which it joins; and he goes on to state that its large size is not to be accounted for by its intercostal factors, but by the junction to it of a trunk from within the vertebral canal, of large size and connected by its constituent factors, as the vena azygos is, with those of the lower cava as also with the lower intercostal veins. If we examine a pig, we shall find it to possess a large azygos vein on the left side; and this the cetacean, it is true, does not; but it will be seen to have on the right side a short vena azygos, just as the porpoise has, with four or five affluents from the upper intercostal spaces, as well as very considerable tributaries from the muscles of the back and scapulae. The vena-azygos system is well known to be intimately connected with venous ramifications situated about, around, between and within the spinal column; and the greater

[1] 'Phil. Trans.' for 1849, p. 152; Milne-Edwards' 'Physiologie Comp.' vol. iii. pl. 2. p. 598.

[2] 'Nova Acta,' vol. xvii. pl. 1. p. 408, 1834; 'Bull. Acad. St. Pétersbourg,' tom. i. 1835; Froriep, 'Notizen,' 50, p. 38, 1836.

development of any one of these vascular connexions does not destroy the distinctive and specific character of that peculiar system. The perirrhachidian or dorsispinal anastomosis is chiefly developed in the right side in the pig, which has a left azygos also; its endorhachidian or intervertebral factors have absorbed its lower intercostal tributaries in the porpoise; and in this animal there is no vena azygos on the left. These points of difference are, however, but slight as compared with the difference which the statements ordinarily made on this point would lead us to expect. The Cetacea, we may add, have been observed to resemble the sheep and pig and horse, in the deficiency of the rudimentary structure known as the Eustachian valve, which, however, is by no means invariably present in deciduate mammals. A few points of resemblance between the placentae of the Ungulata and the Mutica have escaped notice. First, in Cetacea and in certain Ungulata we find the membranes of what is often a solitary embryo prolonged from one cornu round into the other, and projecting by a caecal extremity into the short corpus uteri. Such a condition of the structures is figured from the mare by Colin (l. c.), and has been seen by myself in the membrane of a small cetacean, sp.?; and in the cow and other ruminants a similar extension of the membranes of a foetus lodged in one cornu round into the other is not rarely seen, but without any caecal diverticulum markedly developed in their short corpora uteri. The multiparous sow does not of course resemble its less fertile congeners in this particular; but the membranes of the deciduate and ordinarily uniparous seal (*Phoca vitulina*) have been observed to be confined to the uterine cornu which contained its single foetus [1].

Secondly, we find on the umbilical cord of the foetal cetacean, filiform outgrowths of the amnios which are undoubtedly homologous with the similarly placed growths in the early ruminant, and in the soliped embryo, as well as with those on the amnios of the tenrec, as already described. In the amnios of the pig no such growths are observable, but certain dilated microscopic vesicles [2] have been supposed to take their place and function.

[1] Barkow, 'Zootomische Bemerkungen,' p. 7. [The Editor observed this to be the case also in the grey seal (*Halichoerus gryphus*). 'Trans. Roy. Soc. Edinb.' 1875, vol. 27.]

[2] Birnbaum, 'Untersuchungen über den Bau der Eihäute,' Berlin, 1863, pp. 18 and 67.

On the other hand, numbers of rough granulations exist between the layers of the chorion, and project into the sac of the allantois of this animal at full time; and these structures must find their homologues in the similarly placed outgrowths described by Professor Owen in the membranes of the elephant, and possibly also in the 'hippomanes' of Solipeds[1]. I have observed those growths in the membranes of an embryonic pig of 5 inches in length; and also in the *appendices allantoidis* of the ruminants. From an examination of the membranes of an embryonic cetacean of 7 inches in length, I am inclined to say they exist there also. But a fresh or well-preserved specimen is necessary to decide this point[2]. Finally, the cornual ends of the cetacean membranes just alluded to are bare and glabrous as compared with the villous characters of the rest of the chorion. It is possible that this appearance may have been produced by the treatment to which the membranes were subjected before they came into my hands; but it is also possible that it may be another point of resemblance between the placenta of the cetacean and of the artiodactyla as described and figured by Von Baer[3]. The condition of the cetacean membranes which I have been able to examine has not been such as to enable me to make out the relations of the allantois either to the circumference of the amnios within, or to that of the villous membrane exteriorly. It would be highly interesting and important to have as accurate records of the relations of these parts in the Mutica as we have already of those of the same structures in the Ungulates. In the meanwhile it may be anticipated that no such differences will be discovered as the very great ones which distinguish the carnivorous membranes from those of the other three classes of deciduate mammals of which we have been speaking. Professor Kölliker (l. c. p. 169), whilst adopting Weber's class of deciduate Mammalia, has divided his non-deciduate class into two, the first

[1] 'Hunterian Catalogue,' vol. v. 3558, A.

[2] Such a specimen would be further valuable, as it would enable one to discover whether the Cetacea possess that peculiar vascular arrangement which Von Baer and Eschricht have described in the membranes of the Artiodactyles, and which we may call a 'placental portal circulation.' Eschricht, p. 36; Von Baer, 'Die Gefässverbindung,' p. 10.

[3] Entwickelungsgeschichte,' 252, 254, tab. v. fig. 5; 'Gefässverbindung,' p. 14. fig. 1. [The presence of spots on the chorion free from villi both at the poles and at the surface next the os uteri has been described by the Editor both in Orca gladiator and in the Narwhal. 'Trans. Roy. Soc. Edinb.' 1871, and 'Proc.' 1876.]

of which is represented by the pachyderms, and the second by the ruminants. Of the first of these he says:—

'The placenta is wholly wanting, the connexion of the ovum with the uterus is quite loose, the chorion carries well-nigh over its whole surface small villuli (Zöttchen) which insert themselves into slight (leichte, ? seichte) depressions of the uterine mucous membrane (type of the pachyderms, or of the pig).' Of the second we read, 'There is an intimate union of maternal and foetal structures; yet maternal and foetal placentae are separable without any tearing of tissues.'

It is true that the cotyledon and the caruncle of the ruminant are visible to the naked eye, and the villus and the shallow pit of the pachyderm are best seen with the help of a lens; but this seems scarcely a sufficient ground for such a bifurcation as that made by Professor Kölliker. And when we consider, further, that an undoubted ruminant, the camel, possesses a diffuse placenta and no cotyledons, and that, according to Professor Owen's suggestion [1], the pigmy musk deer (*Tragulus*) will probably be found to be similarly organised, whilst the undoubtedly swine peccary (*Dicotyles torquatus*) approximates markedly to the ruminant [2] not only by the increase of the stomachal cavities, but also by the decrease of the number of its offspring, the secondary division of the non-deciduate mammalia will appear to be even less justifiable morphologically.

Leaving now the consideration of the points in which the non-deciduate mammalia resemble or differ from each other, I will pass in review certain statements which have been made as to the relation of their placental structures to those of the rodents. In the excellent 'Vergleichende Anatomie und Physiologie' of Bergmann and Leuckart I find, at p. 632, the following comparison:—

'To these cotyledons (of the ruminant) the single disk-shaped placenta of the rodents has a strong resemblance, inasmuch as in their case also the maternal part usually projects out from the surface of the uterus in the shape of a button ('mit diesen Cotyledonen hat die eine scheibenförmige Placenta der Nager viel Aehnlichkeit, indem auch hier der Mütterliche Antheil bedeutend knopfförmig aus der Fläche der Uterus hervorzuragen pflegt').

This comparison may seem to be amply borne out by a reference to a vertical section of a single cotyledon of a ewe. But though the appearance of the parts may be much alike, their history and physiology is very unlike. The downgrowth of deciduous serotina

[1] Hunter's 'Essays and Observations,' vol. ii. p. 135. note 3. [The diffused form of placenta has been described by M. Alphonse Milne Edwards in *Tragulus*, and by the Editor and the late Prof. Garrod in *Hyomoschus aquaticus*. 'Proc. Zool. Soc.' June, 1878.]

[2] Ibid. p. 124. note 3, and p. 125.

which comes into relation and connexion with the placenta gives way in the rodent, and allows the cuplike mass which it attaches to the uterine wall to drop freely into the uterine cavity; if it gives way in the ruminant, as it sometimes does, it is a pathological process which entails, *pro tanto*, sterility upon the animal in which it occurs, and has its occurrence marked by the production of a cicatrix. In other words, the fibro-plastic cells which may be found on the utero-placental area of a ruminant, from which the above downgrowth proceeds, are not sufficient for the regeneration of the mucous structures over that area, which perfect regeneration however we do find to take place in the whole class of deciduate mammals. Nor is this all. For though the placenta with its upgrowth (Kern of Bischoff) in the guinea-pig might be taken to represent, though roughly, the cotyledons on the discharged placenta of a ruminant, the structures which they were drawn from in the rodent differ essentially from the placentulae of the ruminants, in that they contain inextricably mixed up in their mass, as a well-injected specimen will always show, maternal elements which the apparently similar ruminant structures do not[1]. In its early attainment of the faculty of self-help, however, in the inguinal position, and in the small number of its mammae, the guinea-pig presents points of real resemblance to the ruminants and also to most other non-deciduate mammals.

Secondly, Professor Owen, in the Linnean Society's 'Proceedings[2],' says of the deciduous portion of the rat's placenta, that it—

'Consists of foetal parts exclusively;' and that the 'structure of the discoid placenta in the *Pteropus*, like that of the rat, more resembles that of the foetal portion of the cotyledon in the cow than that of the cellulo-vascular, spongy placenta of the Quadrumana.'

To this it must be replied that specimens, such as most museums possess, of uteri containing foetuses in which both foetal and maternal vessels have been injected show distinctly that this resemblance does not exist. It is impossible to inject the uterine vessels of any deciduate mammal, at any but the very earliest

[1] It should be borne in mind that, though in the pregnant uteri of these prolific animals the sites of former placentae are recognisable as well as the functional structures, the sites of the two hardly ever coincide. Reichert says that he has only once seen the new placenta attach itself to the place occupied by its predecessor (l. c. p. 130). Matters are altogether different in the ruminants.

[2] l. c. p. 16, note. See also 'Phil. Trans.' for 1857, p. 351.

stages of pregnancy, without leaving much of the injection inextricably interfused with the foetal villi, whereas it is perfectly possible to do this with the ruminant placentulae at any period. The foetal villi of a placenta may be 'long, delicate, and branched, giving a flocculent appearance to the small portion of the centre of the dial by which the foetal placenta is attached to the womb[1];' but it is difficult to see how by this peculiarity they come to resemble 'the foetal portion of the cotyledon in the cow,' unless it could be shown that the uterine vessels when injected in a fresh specimen left none of their own substance or of the tissue supporting them interblended organically with the foetal upgrowths. This can be shown in the ruminants. The delicate arborescent appearance which is described in the placenta of *Pteropus* is due, in all likelihood, to the prolonged maceration in spirit to which a pregnant uterus of an animal of its geographical distribution would in all likelihood be subjected, and it may be paralleled by the appearance which the human placenta, when similarly treated for the purpose of showing its villous structure, may, in most museums, be seen to wear. So far, therefore, from approximating a chiropterous animal to the Pecora of Linnaeus, the placental peculiarity brings them, as Linnaeus did bring them, into the same class as the Primates—the necessary preliminary for the demonstration of an arborescent placenta being, in both cases alike, the washing away of the intervillularly-placed maternal substances[2]. For though it may be possible to make the placentae of other deciduate Mammalia assume an arborescent appearance by maceration, as compared with the human or with the simious placenta they present ordinarily the appearance rather of interdigitating lamellae[3] than that of intertwining trees.

From the facts given in this paper, imperfect as it is from the want of certain materials specified, as well as from other causes, it may seem to result that the modifications of the placental structures form a very safe basis for the classification of the Monodelphous Mammalia.

[1] 'Phil. Trans.' for 1857, p. 351.

[2] Eschricht's words as to this intercellular substance are exceedingly apposite: 'Villos microscopii ope examinans massa grumosa eos obtectos esse saepissime vidi, quam tegumentum esse a tunica serotina praebitum nihil dubito.'—De Organis, p. 127.

[3] Eschricht, l. c. pp. 14, 26; Von Baer, 'Gefässverbindung,' pp. 23 and 24.

Why within the limits of so well-defined a class such wide variety should exist in the means by which is carried on and out that intra-uterine life which every member of the class lives alike, it is difficult for us to understand; but that such variety does exist there is no doubt.

Differences, however, in structural arrangements which do exist, without our being able to see why they should exist, possess a morphological value which rises in direct proportion with their physiological obscurity.

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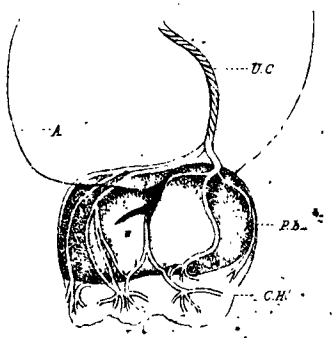
Professor Huxley's views on the placental method of classification were made public in his lectures at the College of Surgeons in the spring of 1853, and these lectures were published about the same time in the 'Medical Times and Gazette.' This I mention in order that the date appended to the last work on my list may not be taken to imply a repudiation of the great obligations I owe to the teaching that book contains.

EXPLANATION OF PLATE 2.

Fig. 1. Placenta of Tenrec (*Centetes ecaudatus*) detached from the deciduous serotina and from the utero-placental area covered with persistent or non-deciduous serotina. Part of the amnios, A, and of the umbilical cord, U C, are left in connexion with the placenta, P L. The umbilical vessels are prolonged up into an upstanding rim of membrane C H′ which is itself an upward prolongation of the chorion, and was continuous with the uterine tissues along a parapet of membrane U P in fig. 2.

Fig. 2. Utero-placental area of Tenrec. U P the parapet of uterine mucous membrane. Within this is a quoit-shaped area of mucous membrane concentrically corrugated: and within it is a space much perforated by orifices of blood-vessels and covered with the non-deciduous or persistent serotina, P S. The presence of the ring of corrugated mucous membrane bounding the non-deciduous serotina and bounded itself by the circular parapet, U P, of mucous membrane, and the presence of an upgrowth of the chorion, C H′, continuous with this parapet, are phenomena, so far as is known to me, unique in the Mammalia.

Fig. 3. Section of uterine cornu and deciduous serotina of Guinea Pig (*Cavia aperea*). The deciduous serotina has been artificially displaced from its natural condition of apposition with the non-deciduous serotina of the uterine wall. It is still



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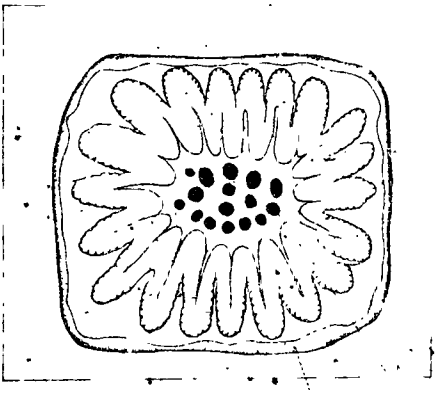

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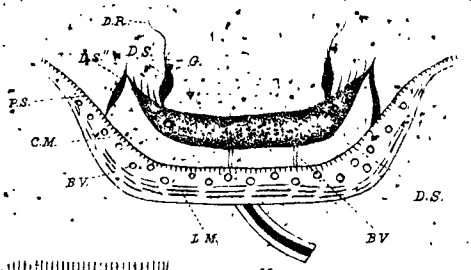


Fig. 3.

Fig. 4.

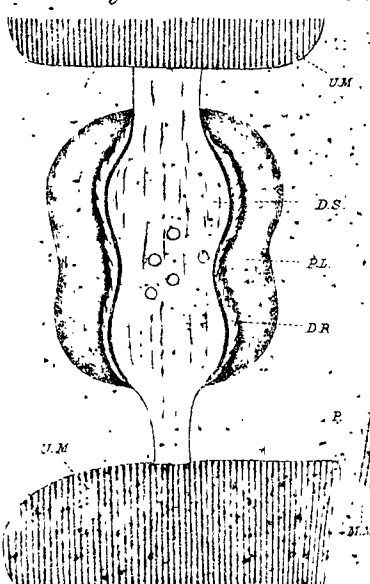
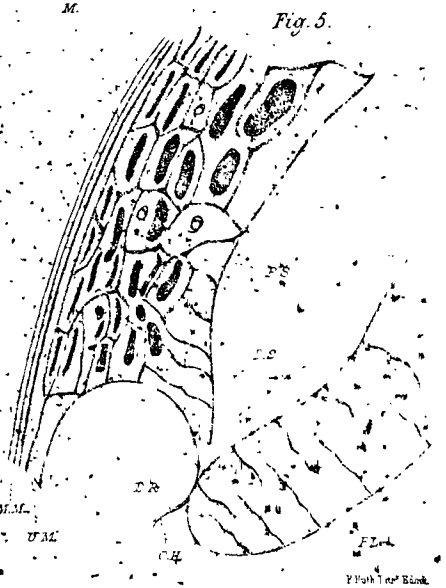


Fig. 5.



PLACENTA OF TENREC.

connected with the uterine tissues by blood-vessels, B V, and by tags or fimbriae, D S″, which pass from its periphery to become continuous with the uterine mucous membrane. From its concave surface there is a downward growth, D S′, which embraced the upgrowth, P L′ (the 'Kern' of Bischoff), and which ends in two processes, the one, D R, being the remnant of the decidua reflexa, the other connected the deciduous serotina with the placenta. The persistent non-deciduous serotina is a very thin layer, not separable as a distinct stratum to the naked eye from the circular muscular coat, C M, but it contains uterine glands. A wide interval, partly artificial, and containing many blood-vessels, B V, separates the circular from the longitudinal muscular coat, L M. The mesometrium, M, is attached to the convex border of the figure.

Fig. 4. Afterbirth of Rabbit (*Lepus cuniculus*), showing the prolongations of the decidua serotina at either extremity of the structure, and their continuity with the uterine mucous membrane, U M. The placenta is obscurely seen to be made up of several (two or more) lobes, which are clamped together by a centrally constricted decidua serotina, D S, the constriction corresponding to the interval between the main divisions of the placenta. The decidua serotina has its long axis at right angles to that of the uterine cornu, to the mesometrial border of which it is, in this as in every other Rodent, attached. From either end a process is prolonged beyond the placental area to become continuous with the uterine mucous membrane on the *free half of* the tube, portions of which are drawn at U M. Fringing the lateral borders of the decidua serotina, along which the uterine mucous parapet was continuous with it, and passing underneath its two prolongations, D S″, is seen the decidua reflexa, which is rudimentary in the Leporidae.

Fig. 5. Part of placenta, deciduae, and uterine walls of Pig-tailed Monkey (*Macacus nemestrinus*). The placenta, P L, has been artificially separated from the utero-placental area, and is kept in connexion with the uterus by a pointed process abutting upon its uterine aspect and consisting of both decidua vera and of persistent and deciduous serotinae. A thin lamina of membrane, D S, is seen in the intervals between the placenta and the utero-placental area, being one part of the decidua serotina, tougher, more coherent, and more separable in this simious than in the human placenta. The persistent serotina, P S, is loosely reticular, but limited towards the placenta by a smooth horizontally lying membrane, which would probably have been deciduous. The decidua reflexa, D R, is represented by a layer on the chorion, C H; it is separated by a wide interval from the non-placental uterine mucous membrane, U M, which might perhaps not have been deciduous. 'Decidua-Fortsätze' are well seen in the section of this placenta as in the human placenta at six months.

XI.

ON THE HOMOLOGIES OF CERTAIN MUSCLES CONNECTED WITH THE SHOULDER-JOINT.

THE main points of the paper which I have herewith the honour of laying before the Linnean Society are, first, that the pectoralis secundus s. levator humeri of birds finds its homologue in the subclavius of mammals, and not in the pectoralis minor of anthropotomy, and, secondly, that the 'epicoraco-humeral' muscle, as described by Mr. Mivart in the *Echidna hystrix* and in the *Iguana tuberculata*, is the homologue of the two former of the three muscles now mentioned. A minor issue will be raised as to the source whence the sternal factor of the avian levator humeri comes to be added to the reptilian epicoraco-humeral, which, as its name implies, has no such mesial point of origin: and it may be stated at once that, though the mammalian subclavius furnishes instances of two methods whereby the subclavius of man may acquire such an accessory point of origin, viz. either by borrowing from the rectus abdominis, or by simple apposition to its head, from the cartilage of the first rib, of fibres from the praesternum on which it abuts; the analogy of other animals seems to point to its being in this latter way that this addition is made. Some other points of less moment will arise in the discussion of these questions, or be brought forward at the conclusion of the argument as to the pectoral muscles. Dissections of the bony structures of the shoulder-girdle of the crocodile, and the coraco-scapular bone of the emu, and of certain of the muscles arising from these bones and passing to the upper extremity in either case, have been chosen for special examination, amongst other reasons, because the structural arrangements of the classes to which they respectively belong express, as has been remarked by anatomists from the time of Meckel ('Vergleichende Anatomie,' vol. iii. p. 194) to that of Mr. Parker

('Shoulder-Girdle,' 1868, pp. 142, 192), certain of the problems of morphology in plainer language than those of most other animals. It was whilst dissecting these and other animals in the light furnished me by Mr. Mivart's papers on the myology of the *Echidna hystrix* ('Trans. Linn. Soc.' xxv. 1866) and the *Iguana* ('Proc. Zool. Soc.' June 27, 1867)[1] that I came to entertain the views which I now put forth, and in which I should have more confidence if I knew them to be in accordance with his views.

The *pectoralis secundus s. levator humeri* of ordinary birds arises from a greater or less extent of the keel and lateral portions of their sternum; and narrowing into a tendon as it passes along the

[1] In the former of these two papers (at p. 395) a very extensive, if not exhaustive, bibliography was given of the many disquisitions which had previously appeared on the subject of the Homology of the limbs and their muscles. To Mr. Mivart's list the following memoirs may be added, most of which are either contemporaneous with or posterior in date to his paper:—

Hermann Pfeiffer, 'Zur vergleichenden Anatomie des Schultergerüstes,' Giessen, 1854.

Professor Haughton, 'On the Muscular Anatomy of the Crocodile,' 'Proceedings of the Royal Irish Academy,' June 26, 1865; 'Ann. and Mag. of Nat. Hist.' Ser. iv. No. 4, April 1868.

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My thanks are due to Messrs. Vrolik, Mivart, Haughton, Wood, and Wyman, for their courtesy in sending me copies of their papers, several of which were thus rendered accessible to me much earlier than they otherwise would have been. Mr. Parker's magnificent volume on 'the Shoulder-Girdle,' recently (1868) published by the Ray Society, furnishes, here and there, hints and guidance for the determination of muscular homologies which no writer can for the future afford to ignore. One of the many pleasing fruits of studying this work is the feeling that by so doing one has fairly earned a right to spare one's self the task of criticising views which must have been formed before Mr. Parker's labours were published.

inner aspect of the coracoid and the inferior surface of the coraco-clavicular membrane, from both of which structures it may receive an accession of muscular fibres, it winds over a pulley formed for it by the bone just mentioned, to be inserted between the insertion of the great pectoral on the radial tuberosity of the humerus, internally, and the tendon of the deltoid as it passes down to its attachment on the outer aspect of the bone, externally. The tendon of the levator humeri holding thus an intermediate position between the tendons of the deltoid and the great pectoral, may receive an accession of muscular fibres from the mesoscapular portion of the scapula; or these fibres, which may have a separate nerve-supply, may have also a separate insertion, from that of the levator, on the humerus. But the pulley arrangement furnished by the coracoid enables the levator in its simplest form to act as a powerful levator of the humerus.

The '*subclavius*' of anthropotomy arises from the cartilage of the first rib, a region into the constitution or near neighbourhood of which Mr. Parker has shown the epicoracoid to enter in several mammals[1]. Under cover of a dense fascia (the 'costocoracoid membrane,' which may be taken to represent in fibrous tissue[2] an aborted large-celled cartilaginous band, which reached in the embryo from the acromion to the præsternum), the subclavius of man passes up to be inserted into the costal surface of the outer half of the clavicle. The relation held by this fascia to the muscle furnishes, as I shall hereafter strive to show, a most important means for differentiating the pectoralis minor of the mammal from its subclavius. The variations which the subclavius presents in anthropotomy cast light, as such variations sometimes do, upon its homological representatives in the lower animals. One of the most important of these variations is the

[1] See 'Shoulder-Girdle,' pl. 26, fig. 10, *Mus decumanus*; fig. 5, *Mus minutus*; figs. 1 and 2, *Mus musculus*; fig. 5, *Mus sylvaticus*

[2] For the representation in fibrous tissue by adult structures of what was cartilage in the embryo, see Parker, *loc. cit.* pp. 182, 184, 197, 198. For the existence of the cartilaginous band, above mentioned, see Gegenbaur, 'Untersuchungen zur vergleichenden Anatomie,' 1865, vol. ii. pp. 15–17, cited Parker, *loc. cit.* p. 223. Prof. Pagenstecher, who however does not mention Prof. Gegenbaur's discovery, speaks, in the description of the dissection of a drill, *Mandrilla leucophæa* ('Zool. Gart.' April 1867, p. 128), of a very fine but strong elastic band, which ran along the upper or anterior border of the pectoralis minor from the coracoid to the anterior end of the second rib, as being the homologue probably of the coracoid of monotremes, birds, and reptiles.

junction to the subclavius of another muscle, which, as arising ordinarily from the sternum, may be called a 'sternoclavicular' muscle[1], and may be thought, by virtue of this its point of origin, to supply to the human subclavius the sternal factor which it requires to make its origin co-extensive with that of an avian pectoralis secundus. The prolongation of the subclavius to the acromion and scapula, so very common in quadruped mammals, is rare in the human subject, its fibres appearing to be, as it were, arrested by the largely developed distal end of the clavicle. One instance of such an arrangement is given as follows by Mr. Wood in the 'Proceedings of the Royal Society,' June 1865, p. 384:—

'In a thin female subject of low stature was found, on the right side only, the remarkable muscle given in fig. 4. It consisted of a roundish fusiform slip (*a*), arising tendinous from the first cartilage below the subclavius, close to the manubrium sterni, passing across the subclavian vessels and nerves, quite distinct from the last-named muscle, and inserted into the upper border of the scapula and suprascapular ligament, where it was connected, to some extent, with the origin of the omo-hyoideus (*e*). From this point of insertion another slip of muscular fibres passed forwards, upwards, and outwards, to be inserted, with the subclavius, into the outer third of the clavicle.

'This muscle seems to be the same as that given in the author's first series under the name of a double subclavius, with the addition of a connecting slip to the clavicle. It seems to the author to represent pretty closely the sternoscapular muscle, while contributing to support the thorax in the Pachyderms and Ruminants, in which animals it is continued as far as the manubrium.'

It is singular that in the crocodile some of the fibres of the omohyoid are, in young specimens at least, continuous with fibres of the epicoraco-humeral; and it is obvious that if, in the case just quoted from Mr. Wood's paper, the fibres thus continuous with the omohyoid had been prolonged a little, so as to become continuous with those of the deltoid or supraspinatus, we should have had here a muscle corresponding both in origin and in insertion very closely with the pectoralis secundus s. levator humeri of the bird.

Now, as the following account of a dissection from the guinea-pig will show, just such a muscle exists in that animal:—

In the guinea-pig (*Cavia aperia*) the subclavius muscle, the smaller 'sternoscapular' of Mivart and Murie ('Proc. Zool. Soc.' June 1866, p. 398), arises from a small surface on the praesternal proosteon and from the cartilage of the first rib, exteriorly to which latter point

[1] For instances of this 'second subclavius' see Wood, 'Proc. Roy. Soc.' June 1864, p. 300, June 1865, p. 384, and June 1866, p. 238; Macalister, 'Proc. Roy. Irish Acad. Dec. 1867.

of origin the epicoracoid has coalesced with the vertebral rib. It passes up behind the osseo-cartilagino-fibrous bar made up of ligaments, praecoracoid, clavicle, and mesoscapular segment (see Parker, l. c., pl. 24. fig. 6) and reaching from the apex of the anterior prolongation of the sternum to the acromion and coracoid. Some of its fibres are inserted into the coraco-clavicular ligament, and some, though fewer, into the clavicle itself. But from the clavicle it receives a large accession of muscular fibres in return; and these, joining with the fibres of the original muscle, pass on to be inserted along the anterior edge of the acromion, and also to become continuous along the mesial or downward-looking edge of the metacromion with fibres of the deltoid, which take origin from the ligament prolonged inwards from the acromion to the clavicle. Thus, though the greater part of the fibres of the subclavius are arrested by a bony fixation into the acromion, which, it will be recollected, is, in these proportions at least, an exclusively mammalian development, it becomes, by the continuity of its innermost fibres with the soft tissues placed mesially to that process, more or less physiologically as well as morphologically equivalent to the pectoralis secundus or levator humeri of the bird. A larger muscle, the larger 'sternoscapular' of Mivart and Murie, arises from the mesosternum in the guinea-pig, and takes a similar course to that of the 'subclavius,' with which it interchanges fibres at the clavicle, to which they both have an attachment. It is inserted, however, along the upper vertebral border of the scapula; and three-fifths of the entire length of the spine of that bone intervene between its insertion and that of the subclavius. If we consider that the 'subclavius' here has an origin, as it has also in the crested agouti, *Dasyprocta cristata* (Mivart and Murie, l. c. p. 398), and in other mammals, from a sternal as well as from a costal element in immediate connection with the epicoracoid, and, indeed, also with the praecoracoid, we may think ourselves justified in regarding the muscle with these points of origin as the morphological equivalent, as to its origin at least, of the entire pectoralis secundus of the bird, independently of the 'greater sternoscapular' muscle. But, inasmuch as the pectoralis secundus of the bird shows some tendency to self-multiplication, as seen in the sub-order Gallinae, it may be well to consider the two sternoscapular muscles as, either severally or fused, homologous with either two distinct pectorales secundi or

a single one. The rectus abdominis is prolonged up to the first rib, and is overlapped in the guinea-pig by a muscle homologous with that figured at *e o* in fig. 3, of the crocodile's shoulder-joint muscles; but it does not give any tendinous or muscular factor to the subclavius here, as it does in the wombat (*Phascolomys wombat*). A description of the arrangement of these parts in this latter animal will be found in my description of fig. 3, which, though taken from a dissection of a crocodile, makes the account of the structures, as seen in the wombat, much more intelligible. Both descriptions alike warn us not to lose sight of the possibility that the avian levator humeri may have borrowed a factor from the anterior prolongation, over the sternum, of the rectus abdominis. The arrangement of these selfsame structures in the aardvark (*Orycteropus capensis*) enforces the same lesson. In this animal (a detailed account of the myology of which, by J. C. Galton, Esq., appears in the Linnean Society's 'Transactions,' vol. xxvi. p. 571) the subclavius arises from the manubrium, from the cartilage of the first rib, and from the tendon of the rectus abdominis as it passes upwards to be inserted into the manubrium and first rib. The muscle is folded upon itself much as the pectoralis major is in the human subject; the concavity of the pouch thus formed looks inwards. The inferior or superficial portion of the muscle passes upwards; and its tendon spreads into the fascia covering the supraspinatus, and thus is inserted into the acromion at its root, whilst towards its apex, by the intermediation of fascia covering the acromion, it can act upon the fibres of the deltoid taking origin there. The portion of the muscle which lies deeper or more dorsally is inserted into the coracoid, into and along the coraco-acromial ligament, into a detached ossicle, which lies outside the angle formed by the meeting of acromion and clavicle, and finally into the clavicle. But the clavicle seems to give fibres to the subclavius, as well as to receive the insertion of fibres from it; these fibres, however, are but few in number, and seem to lie between the superficial and the deep portions of the muscle.

The subclavius of certain New World monkeys (*Mycetes seniculus* and *Mycetes geoffroyi*) furnishes us with a stepping-stone whereby to pass from the subclavius of the three mammals just treated of to the subclavius of anthropotomy. In these monkeys the subclavius takes origin from the junction of the first costal

cartilage, not with the sternum, but with the rib, and it is inserted into the outer and under surface of the clavicle and into the coracoid. But it has no origin from the sternum, and no scapular nor any humeral insertion, either direct or indirect.

The human subclavius may have an insertion into the coracoid (Wood, 'Proc. Royal Soc.' June 1864, p. 300); but such an aberrant slip as that recorded by Ganzer (cited by Mr. Macalister, 'Journal of Anatomy,' May, 1867, p. 318) as passing in the human subject 'from the cartilage of the first rib to the capsule of the shoulder beneath the pectoralis minor' I should be inclined to look upon as merely a part of the deeper layers of the pectoralis major, which took origin as much higher than those layers do ordinarily reach, as the slip of muscle *e o*, figured from the crocodile in Plate 3, fig. 3, takes origin higher than the external oblique does ordinarily.

I may now pass by a natural transition to a vindication of my proposition, that the pectoralis secundus or levator humeri of the bird does not find its homologue in the pectoralis minor of the mammal. For the establishment of this negative proposition, it is not sufficient to say that in each of the mammals (from dissections of which I have described a subclavius apparently homologous in origin, course, and insertion with the avian pectoralis secundus) a muscle homologous with the human pectoralis minor is also found, and that this coexistence disproves the view which asserts these two pectorales to be homologous; for the pectoralis minor may be multifid, and many instances have been put on record in which it forms a groove for a portion of its fibres in the coracoid, and working in it as over a pulley, comes, either directly or through the intermediation of the supraspinatus (which these fibres join), to act as an elevator of the humerus (see Macalister, 'Proceedings Royal Irish Academy,' Dec. 1867; 'Journal of Anatomy,' May 1867, p. 317; Wood, 'Proceedings Royal Society,' May 1867, p. 524, June 1866, p. 231); and it is plain *a priori* that for the formation of an avian pectoralis secundus by the pectoralis minor, and for the alteration of its functions from that of a depressor into that of a levator humeri, all that is necessary is the provision for its tendon of some such pulley-like arrangement by the coracoid. What I have to show is that, as a matter of fact, the muscle which, in the economy of nature, has been worked up into the avian

levator humeri is one and not the other of two, either of which, so far as we can see, might have been so employed.

I cannot adopt Prof. Pagenstecher's views ('Zool. Gart.' April 1867, p. 125), according to which the two mammalian pectorales are referred to two entirely distinct sets of muscles, the pectoralis major being one of a ventral, and the pectoralis minor one of a dorsal series. The single fact of their both receiving a nerve-supply from the same nerve (the internal anterior thoracic) seems to be conclusive against the validity of this suggestion. And I believe further, that it is impossible to observe how the posterior fascicles of the pectoralis major in the lower Mammalia have their tendons prolonged up from the lesser tuberosity of the humerus and the bicipital groove, which is bridged over by pectoral tendons, to the coracoid process, without being convinced that the pectoralis minor of anthropotomy is but a specialised anterior fascicle of the deeper portions of the pectoralis major. The commonest variation, according to Mr. Macalister ('Journal of Anatomy and Physiology,' May 1867, p. 317), which the pectoralis minor exhibits in man is an insertion of the lowest part of its tendon, missing as it were the coracoid process, into the coraco-brachialis muscle.

The arguments which I shall now adduce to show that the pectoralis minor is not the homologue of the avian pectoralis secundus will at the same time go some way towards proving that the primary insertion of the mammalian muscle is a humeral one, more or less internally to the tendon of the superficial layers of the greater pectoral, whilst the primary insertion of the avian is also a humeral one, but one more or less externally placed to that of the great pectoral depressor of the humerus. The attachment of the mammalian pectoral to the coracoid is secondary in its history; and the like place in the series of its specialisations is held by the development of the coracoid pulley in the history of the avian pectoralis secundus. The insertion of the 'subclavius' into the clavicle and the junction of the 'pectoralis minor' with the supraspinatus will be seen in the course of the argument to be exclusively mammalian developments. Now there are three lines of argument for showing the homological identity or non-identity of any two muscles. The first line of argument shows that they hold the same or different relations to the other structures they are connected with at their origin, in their course, or at their

insertion. The second shows that they are or are not supplied by the same nerve or nerves. The third shows that either in their adult condition or in the condition of development they are independent or connate. A comparison of the pectoralis minor of the mammal with the pectoralis secundus of the bird furnishes us, under each of these three heads, with an argument for their non-identity. Under the first head I would observe, as Prof. Pagenstecher has already been quoted as doing, that the pectoralis minor of the mammal lies to the outer side of the costocoracoid membrane, to the inner side of the homological representative of which structure, viz. the coracoid, the pectoralis secundus of the bird passes. I do not mean to deny, nor yet to affirm, that the pectoralis minor of the mammal may not be one of the same series of muscular fasciculi as its subclavius; what I do affirm is, that there is a certain landmark between these two muscles enabling us to separate them into two sets, and that there is a similar separation recognisable in the bird, of similar muscles by means of a similar landmark. Under the second head I shall show that the subclavius of the mammal is supplied by a nerve homologous with the nerve which supplies the pectoralis secundus of the bird, and that the pectoralis minor is not supplied by that nerve, but by the same nerve as that which in the bird supplies the great pectoral. And, thirdly, I shall show that in the developing bird it is possible to see that the pectoralis major is really the equivalent of both pectorals of the mammal. The facts of the anatomical arrangements in any single bird will give my arguments in their most intelligible form; and I will proceed to give them in an account of the structures in question, as seen in the common sparrow-hawk (*Accipiter nisus*).

The pectoralis secundus s. levator humeri has a much smaller area of origin from the sternum and its keel in the sparrow-hawk (*Accipiter nisus*) than in the common fowl. It receives, however, an accession of fibres, first from the anterior inferior angle of the coracoid, and secondly from a large head which, arising from the posterior or upper surface of the coracoid groove in the sternum, from the lateral aspect of the sternal rostrum, from the upper surface of the inner angle of the coracoid itself, and, finally, from the upper surface of a fibrous band which passes from the posterior lip of the coracoid groove in the sternum to fix itself to the

posterior and inner edge of the coracoid at about the middle of the height of the bone, may be considered the homologue of the large 'coraco-brachialis superior' of gallinaceous birds[1]. A dense band of ligamentous tissue (homologous probably with the praecoracoid of the lizards) stretches in the coraco-clavicular membrane from the sternal rostrum to the upper end of the clavicle; and from it a thin sheet of muscular fibres arises, which joins the tendon of the pectoralis secundus in the pulley, as does also a slender slip of muscle which passes from the mesoscapula. The main mass of the pectoralis secundus is of a deeper colour, especially in young birds, than these two latter muscles, which join its tendon; and it is to be remarked that the main mass, as well as the former of these accessory slips, takes origin from the fibrous band in the coraco-clavicular ligament.

A ligament passes from the anterior external angle of the coracoid at its sternal articulation (the 'epicoracoid' of Parker) to be inserted on the sternum at a point about opposite the articulation of the third sternal rib. It limits the fibres of the pectoralis secundus mesially from those of the so-called 'subclavius' (No. xi. of Schoepss[2]) externally, at the point where these latter pass upwards and inwards to attach themselves to the base of the coracoid. Inasmuch, then, as the two layers of the 'subclavius' of the bird are homologous serially with the two layers of the intercostals, this ligament may be considered homologous with the mesial attachment of the costo-coracoid membrane, which separates the 'subclavius' of the mammal from the insertion of the internal intercostals, the serial homologues of the deep layer of the subclavius of the bird.

Secondly, the nerve which supplies the pectoralis secundus of the bird is obviously homologous with the nerve which supplies the subclavius of the mammal, and not with the nerves which supply the greater and lesser pectorals in that class. The nerve to the bird's pectoralis secundus comes, in the *Accipiter nisus*, from the anterior factors and lower aspect of the brachial plexus;

[1] The lower part of this latter muscle is aborted as far as its ordinary direction is concerned, its upper part being represented by a very slender slip which arises from the posterior aspect of the mesocoracoid region close to the glenoid, and, taking the usual course of a coraco-brachialis, is inserted with the subscapularis.

[2] 'Beschreibung der Flügelmuskeln der Vögel,' von C. G. Schoepss, Meckel's Archiv, 1829, p. 72.

and the nerve corresponding to the external respiratory of Bell comes off from the dorsal surface of the same part of the plexus, just as the subclavius and external respiratory do in man, whilst the nerve to the great depressor pectoral muscle comes off lower down, and does not send any branch to the pectoralis secundus, which, if it were the homologue of the pectoralis minor, it would do. In the sparrow-hawk the trunk formed by the first and second of the cervical nerves, which join to form the plexus, gives off nerves to the subscapularis, the teres major, the subclavius, and the pectoralis secundus. The nerve to the last muscle is the first one given off from the front of the plexus, and it gives no branch to any other muscle. The external respiratory nerve, which passes down behind the brachial plexus and between the serrati antici and the ribs, has one root from the second factor of the plexus and one from the third. Its origin therefore, and distribution, and its relation to the nerve to the pectoralis secundus, are close enough in resemblance to those of the human external respiratory to leave no reasonable doubt as to its homological identity with that nerve, and, by consequence, as to the identity of the nerve to the avian pectoralis secundus with the nerve to the mammalian subclavius. The nerve to the pectoralis major of the sparrow-hawk is given off from a point lower down in the plexus; and the three main trunks, which mainly make up the plexus, seem, as in the alligator, all to give factors to it. It can scarcely be doubted that this nerve is the homologue of the two anterior thoracic nerves of the mammal.

If, thirdly, we are asked, Where is the second pectoral of the mammal to which the anterior thoracic nerves supply fibres as well as to the pectoralis? the answer furnishes us with our third argument, and runs thus: In the young sparrow-hawk it is easy to divide the pectoral mass into two strata, the upper and deeper of which is much the feebler, but which is continued into a tendon continuous, indeed, with that of the pectoralis magnus on its deep surface, but prolonged upward, from its primary insertion into the inner tuberosity, very distinctly to the coracoid, being loosely connected with the tendons of the biceps, and ultimately attached (which the tendon of the biceps is not) to the precoracoid epiphysis of the clavicle. The description which I have given of the posterior layers of the great pectoral of the young bird is not, as far as

I know, verifiable in the muscle, though it is in the tendon, of the adult. But it corresponds very closely with a description of the posterior layers of the great pectoral in the common rat (*Mus decumanus*); and it is difficult to see how it is possible to deny the homology of the upper fascicles of the posterior layer of the great pectoral in this animal with the pectoralis minor of man. The nerve-trunk which thus supplies in the bird what I hold to be the homologue of the two pectorales of anthropotomy does, it is true, give off a nerve to one other muscle, viz. the coraco-brachialis inferior, or pectoralis tertius, a muscle which arises from the posterior three-fifths of the outer and inferior edge of the coracoid, and is inserted into the inner tuberosity just inside the most mesially placed portion of the crateriform rim which it throws up round the mouth of the pneumatic inlet. But this nerve-trunk seems to me to be the homologue of the musculo-cutaneous nerve of anthropotomy, which supplies the coraco-brachialis, and is given off from the same outer cord of the plexus, whence the external anterior thoracic arises.

By studying the four figures in Plate 3, and the descriptions given of them, a better comprehension of the bearings of my position, that the pectoralis secundus of the bird is homologically identical with the epicoraco-humeral of the reptile, will be gained than could be conveyed by any disquisition, however lengthy, if unaccompanied by illustrations. The name 'epicoraco-humeral' has been given by Mr. Mivart ('Trans. Linn. Soc.' vol. xxv. p. 383; 'Proc. Zool. Soc.' June 27, 1867, p. 778) to a muscle found both in the *Echidna hystrix* and in the *Iguana tuberculata*, which arises from the precoracoid and epicoracoid in the reptile, and from the epicoracoid in the reptile-like mammal, and is 'inserted into the summit of the radial tuberosity between the insertions of the pectoralis major and deltoid.' It was by recognising in the shoulder-muscles of the crocodile (fig. 3, *eh*) the homologue of this saurian muscle, and by comparing it, when thus recognised, with the highly simplified pectoralis secundus (fig. 4, *eh*) of the emu (*Dromaius novae hollandiae*), that I came to hold the view which I now put forth. The great reduction, already spoken of, which the sternal origin of the accipitrine levator humeri has undergone, as compared with the vast pectoralis secundus of the Gallinae, prepares us somewhat for finding in the emu a pectoralis secundus

which, while it coincides in insertion, differs little in origin from the epicoraco-humeral of the crocodile, except in the possession of a small head from the middle point of the sternum. The essential relations held by the muscles lettered *e h* in each of the two figures 3 and 4, to the surrounding parts, seem to be much the same in the intervals between their origin and insertions. The crocodilian muscle, however, receives a head from the visceral surface of the scapula, in compensation for the absence of the fibres which in the emu arise from the coraco-clavicular membrane and sternum, but which in the reptile appear to have been displaced by its great pectoral from its less-developed sternum. The pectoralis secundus of the sparrow-hawk, as already described, receives in a similar way an accession of fibres from the visceral surface of the coracoid and sternum. It is possible that the fascicle *ei* in the crocodile, if the homologue of a dislocated anterior segment of rectus abdominis, may foreshadow the sternal prolongation of the avian levator humeri. But though this muscle seems exceedingly ready to build up extraneous elements into its own mass, it is perhaps more easy, with our knowledge of this muscle, as it is to be described hereafter in the frog, to conceive the epicoraco-humeral as encroaching from its own area on to that of the sternum, than to conceive of it as fusing with a 'rectus thoracis,' even though the subclavius of the wombat does actually do this.

Another point of difference is presented by the retention in the emu of a rudiment of the coracoidal pulley, which is not indicated in the crocodilian shoulder-girdle, either as a nascent or as a retrograding structure. The pectoralis secundus of birds does not by any means invariably receive fibres from the coracoid; it does receive such an accession in the sparrow-hawk, but it does not do so in the pigeon (*Columba livia*) for example; it may (as seen in great simplicity in the emu and apteryx) have a mesoscapular factor actually joined to its tendon, and inserted so as to be one in function with it, and it may be considered, therefore, to be essentially a sterno-praecoraco-scapular muscle. The sternal factor is lost in the ostrich (*Struthio camelus*), and in the rhea (*Rhea americana*). Similarly the muscle figured at *e h*, fig. 3, from the crocodile, is simply a 'praecoraco-scapularis,' with one head arising from the anterior surface of the expanse of bone constituted by the confluence of scapula and coracoid in

front of the glenoid cavity, and with a second which joins the first on its mesial border, as it passes round from the internal surface of the scapula, and is inserted into the outer tuberosity of the humerus, in close connexion with the upper edge of the great pectoral. In the descriptions given of this muscle, both in the crocodile and in the *Ornithorhynchus*, it has been confounded with the deltoid. It is, however, shown by its innervation to be separate from it in nature; and its insertion lies between the insertions of the deltoid externally and that of the pectoralis major internally. This muscle has a single tendon in the sparrow-hawk, with three muscular heads converging upon it. In the Gallinaceous birds (*Gallus gallinaceus* and *Phasianus colchicus*) the levator-humeri apparatus consists of three muscles, distinct both in origin and insertion, and innervated from two distinct sources. The largest of the three levator muscles of the Gallinaceous humerus has a very extensive origin from the sternum; but, as is the case in the pigeon also, it has no distinct accession of fibres from the coracoid; but from the coracoid on its inner aspect, from the coraco-clavicular membrane, and from a small portion of the sternum a lesser levator humeri arises, which is inserted, after passing through the coraco-scapular canal and over the coracoid pulley, together with the tendon of the greater levator, between the point of insertion of this muscle (which is a little lower down, and more externally placed) and that of the great pectoral to its inner side. With the tendon of the greater pectoral depressor that of the lessor levator is very closely connected, as is that of the epicoraco-humeral of the crocodile; and it is only the presence of the pulley arrangement which converts cooperation into antagonism.

Thirdly, the small muscle which has been described as passing to the single levator tendon of the sparrow-hawk from the mesoscapula of that bird, has in the Gallinae a larger size, a more extensive origin, and a separate insertion. It arises from the uppermost and innermost scrap of the scapula, i.e. from the 'mesoscapula' of Parker, from the ligament which passes along the inner aspect of the coracoscapular canal from the mesoscapula to the coracoid, and from the innermost and uppermost scrap of the coracoid itself. Its tendon is inserted externally to that of the smaller levator humeri, internally and proximally to that of the great levator. In the common goose this muscle, the 'deltoides externus' of Meckel, is fused with a

muscle of the same origin as the smaller levator of the fowl; and we have thus an intermediate stage between the trifid insertion of the levator-apparatus of the fowl and the single tendon of the hawk. It will be obvious that the 'deltoides externus' of the common fowl corresponds, both as to origin and insertion, with the anterior or praeglenoid head of the 'epicoraco-humeral' of the crocodile, and that its smaller levator humeri corresponds as closely, *as to its insertion*, with the postscapular head of that reptilian muscle; and it might seem, therefore, that the larger levator humeri muscle of the fowl remains without a separate homologue in the reptile, were not this muscle innervated by the same subclavius nerve as the reptilian epicoraco-humeral, whilst the smaller levator humeri is, together with the deltoides externus, innervated from the circumflex. To an objector who denies the validity of this argument, and lays stress on the fact that the reptilian muscle has not the sternal factor of the avian pectoralis secundus, I reply, first, in the emu a muscle very unmistakeably homologous with the praecoraco-scapularis of the crocodile possesses but a very small sternal factor; and, secondly, in the ostrich (*Struthio camelus*), which also retains a pectoralis secundus, this sternal factor is aborted and lost. Stages of successive degradation from a highly specialised structural arrangement may well serve to guide our judgments in problems such as these, if it be true that the essential elements of a structure are the last which it loses so long as it retains any actual functional power at all. But, thirdly, lower types than even the scaly or loricate reptile may have an epicoraco-humeral with a sternal factor. This is the case in the frog, where the epicoraco-humeral (the 'pars clavicularis deltoidei' of Ecker, 'Die Anatomie des Frosches,' p. 97) arises from what Mr. Parker ('Shoulder-Girdle,' pp. 79, 80, and pl. v.) has shown to be the praecoracoid and the omosternum.

With this I close my case for proving that the epicoraco-humeral of the reptile is the homologue of the pectoralis s. levator humeri of the bird. It is not necessary for the acceptance of this conclusion that a person should accept also the Theory of Progressive Evolution. By speaking of organs as being '*homologically* identical,' a person who is either averse to pronounce himself, or anxious to secure a dispassionate consideration from all parties, or both, may avoid pledging himself either to the theory which teaches that they are so by virtue of the 'secret bond' of their 'conformity to type,' or to

that which explains their oneness by a reference to 'genetic affinity.' As to which of the two theories a man will take for his guide in research, so far as any theory can serve for a guide in research, much will depend upon the idiosyncrasies, original or acquired, of individual minds. But though the theory may have only a subjective, the facts have an objective cogency.

With regard to the serial homologies of the fore and hind limbs, and, first, with regard to the representation of the ulna by the fibula and of the radius by the tibia, I have much pleasure in referring to Professor Pagenstecher's views, inasmuch as with many other of his conclusions I cannot bring myself to agree. But anybody who will look at his figures of the bones of the human arm and leg, placed side by side, each in the position which best shows their homotypical relationship, will have good reason for acquiescing in the view stated in the following sentence. In those figures we have the limb in either case so flexed as to have the angle formed at the knee and elbow respectively pointing upwards; the fore-arm is supinated, and the hand segment hyper-extended, so as to make almost a right angle with the long axis of the fore-arm. The ulna then lies and is directed a little posteriorly and dorsally as regards the radius; and the thumb and great toe, as also the little finger and the little toe, occupy, severally, corresponding positions. A very similar position, I may observe, is instinctively assumed by a man when he uses his pectoral muscles for the purpose for which quadrupeds ordinarily employ them, viz. for raising and supporting the trunk upon the fore limbs. And an observation of the position assumed by a man who puts himself into a quadrupedal posture for the purpose of drinking at a stream, or who raises himself by the help of his arms from a low seat by placing his hands on the table at which he is sitting, will illustrate the relations of the extensor and flexor, and of the inner and outer aspects of the two limbs, as well as the most detailed parallelisation of the skeletal elements.

Secondly, a study of Mr. Parker's descriptions and histories of the shoulder-girdle will leave no doubt on the mind of any one, I apprehend, as to the serial homology of the coracoid with the ischium, and of the praecoracoid with the os pubis. The shoulder-girdles of the frog and the chelonians are especially instructive when compared with the pelvic girdle of the crocodiles. Express utterances as to the relationship of the two sets of bones may be

found in Mr. Parker's work 'On the Shoulder-Girdle and Sternum,' at pp. 7, 59, and 83.

Professor Huxley's view (which has been adopted by Mr. Mivart, and a similar one to which, I am informed by Professor Turner of Edinburgh, was entertained by his predecessor Professor Goodsir), as to the homotypical relationship of the subscapularis and teres major, not to the iliacus and psoas, but to the middle and smallest gluteus, is a third point for discussion, and one which does not admit of being decided quite so cursorily as the two I have already glanced at. For the acceptance of this apparent paradox, it is necessary first to accept the principle that the true homology of a muscle is to be determined by its insertion (see Mivart, 'Trans. Linn. Soc.' vol. xxv. pp. 398 and 400). To this principle I should give a general assent, without forgetting that we may find exceptions to it, such as the insertion of the pectoralis major of the sparrow-hawk into both tuberosities of the humerus, such as the occasional insertion, in the way of corollary to this first exception, of the pectoralis minor into the outer tuberosity of that bone, or such, thirdly, as the insertion of the psoas of the crocodile on the outer, while the iliacus is inserted on the inner side of the femur. In these cases, however, rudiments at least of the primitive insertion in the shape of aponeurotic bands will ordinarily be left remaining, as if to indicate that it has been, so to say, not by an arbitrary transference, but by a gradual lateral extension that the alteration of the point of attachment has been effected: and the essential character of a muscle may be considered to be as little affected by these transgressions of its ordinary limits laterally, as the essential character of a muscle which is ordinarily inserted into the proximal segment of a limb is considered to be affected by its occasional prolongation into a distal segment, by fascia or aponeurosis, which may finally be specialised into a tendon. There are, however, three sets of anatomical facts to which I would draw attention, as they seem to me to make the denial of the homotypical relation of the iliacus and subscapularis, and the ranking of the latter muscle with the glutei, less of a stumblingblock. First, there can be no reasonable doubt that the essential character of the muscle I have called 'epicoraco-humeral' in the crocodile, is determined by its innervation and by the insertion or wedging in of its tendon on the outer surface of the humerus between those of the pectoralis major and

deltoid. Yet, as is seen by fig. 3, this muscle receives a head from a surface of the scapula as completely turned viscerad as the iliacal surface of the ilium ever is. The origin of the slender epicoraco-humeral of the chamaeleon is limited to the external surface of its coracoid and praecoracoid; but its supraspinatus, if we may so style the muscle which comes next in order from below upwards after the deltoid, does receive just such a factor from the visceral surface of the scapula as does the epicoraco-humeral of the crocodile. This muscular belly having the stem of the scapula placed exteriorly to it reminds one forcibly of the relation held by the os ilii to the iliacus; but the lesson which it teaches does not depend upon such resemblances as this, but upon the retention to some extent by the chamaeleon of the primitive rod-like character of the scapula, which makes it easier for us to see how it may rotate any one of its surfaces, when developed like the fluting on a column, into several different bearings in different animals. It is easier for us to understand how a muscle can wrap its origin round and about the various aspects of a cylindriform, than it is for us to conceive of similar indifferentism in the various surfaces of a many-facetted bone; and upon the conquering of this difficulty depends our power of homologising the spinati with the iliacus[1].

A second argument in the same direction presents itself from another quarter, that of innervation. The homologies of the nerves of the two limbs are much masked by the iliopsoas having carried with it in front of the pubic arch the anterior crural nerve—as also by the separation from this nerve of the peroneal trunk, which is seen, by its distribution, to correspond mainly with those elements of the musculo-spiral nerve which are distributed in the distal segments of the upper limb. But if we place side by side, with diagrams of the nerves of the two limbs, such as those given in plates iii. and iv. of Mr. Flower's 'Diagrams,' tables which give the spinal nerves to which the nerves of the limbs are ultimately traceable, we see that the suprascapular nerves correspond with the nerves to the iliacus, and the nerve to the subclavius with the branch

[1] The so-called 'third or deep head' of the *Iliopsoas* (see Henle, 'Handbuch Anat. Mensch.' i. 3. 242), the musculus iliacus internus minor of Luschka ('Anat. Mensch. ii. 2. 131) is described by the latter anatomist as lying quite exteriorly to the pelvic cavity. It comes thus to correspond most instructively with a teres minor. Similarly helpful is the large size of the facet of origin of the teres major in such an animal as *Ursus maritimus*.

of the obturator to the inner head of the pectineus. The branch from the anterior crural, or from its internal cutaneous division, to the outer head of the pectineus answers to the circumflex, whilst the muscle, by having these two sources of nerve-supply, corresponds, even curiously, with the two levatores humeri of the fowl, and the glutei nerves and muscles are then left as homologues of the subscapular, teres major, and latissimus dorsi.

Thirdly, there can be little doubt that the coraco-brachiales, superior and inferior, of Meckel (no. xvi. and xvii. of Schoepss), in the bird correspond, not only to the adductores in the lower limb, but also to the obturator internus and externus, arising as they do, the former from the visceral, and the latter from the external surface of the parts homologous with the points of origin of the two obturatores. Now, close as is the relation between the tendons of the smaller glutei and the obturatores at the external or larger trochanter of the human femur, it is not at all more intimate than that which subsists between the tendons of the coraco-brachiales and those of the subscapularis and teres major on the lesser tuberosity, as represented by the crateriform rim of the pneumatic foramen. If the superior coraco-brachialis, the origin of which is described in my account of the muscles of the sparrow-hawk, be the homologue of the obturator internus, it is difficult to deny the homology of the subscapularis (with the tendon of which its tendon fuses) with the gluteus medius, which holds so much the same relation by its tendon to the obturator internus.

Leaving now the subject of the homology of the subscapularis and teres major with the glutei, I may refer to the nerve-supply of the teres minor from the same nerve, the circumflex, which supplies the deltoid, as showing that this muscle is really but a divarication of the deltoid posteriorly, as a similar line of argument shows the tensor fasciae femoris to be of the gluteus medius. The difficulty, therefore, as to the nomenclature of the muscle, which in Saurians and the monotrematous Echidna (see Mivart, 'Trans. Linn. Soc.' vol. xxv. p. 384, and 'Proc. Zool. Soc.' June 1867, p. 778; Stannius, 'Handbuch der Zootomie,' ii. p. 126) has been sometimes called 'teres minor' and sometimes 'a second part of the deltoid,' may be met by saying that the posterior factor of the 'deltoid' is not, in these lower animals, differentiated into a superficially placed 'deltoid' and a deeper lying 'teres minor.' There is ordinarily no

infraspinatus differentiated from a supraspinatus in either bird, saurian, or crocodile. But both these latter classes possess the muscle which, with the origin of the teres minor, has the insertion of the teres major, and is called 'subscapulo-humeral' by Macalister ('Proceedings Royal Irish Academy,' December 1867) and Wood ('Proceedings Royal Society,' May 23, 1867, p. 534), 'infraspinatus secundus' by Professor Haughton, 'teres major' by Stannius ('Zootomie,' ii. p. 128, 2nd ed.), and, finally, 'teres minor' by many anatomists, though incorrectly, if the insertion is to determine the name and nature of a muscle rather than its origin. Meckel ('Vergleichend. Anatomie,' iii. p. 512) uses this last nomenclature, speaking of a muscle with the origin and insertion specified as a 'teres minor,' and stating that it is found in the horse, in ruminants, in the aï, and in the mole. A few birds possess this accessory teres major. In the common fowl it arises from the outer surface of the scapula, a little way anteriorly to the downward-growing process, so well marked in the gallinae and in the dodo, which receives the tendon of the anterior portion of the serratus anticus. It is inserted on the posterior lip of the pneumatic foramen, a point serially homologous with that of the insertion of the smaller glutei of human anatomy.

This muscle is not possessed by the common pigeon, but it is found in the common buzzard and sparrow-hawk, and in the goose. The teres major proper is of very large size in ordinary birds; it is present in the crocodile, but absent in saurians. It is not inserted with the latissimus dorsi in the sparrow-hawk, but passes to the anterior lip of the entrance to the pneumatic foramen, to a point just opposite to that of the insertion of the accessory teres major.

In birds there is no praescapular region (Parker, 'Shoulder-Girdle,' p. 143), and consequently no supraspinatus. Indeed, as the supraspinatus of Meckel, l. c. p. 313 (no. xv. Schoepss), receives its nerve-supply from the circumflex, and must be looked upon as a part of the deltoid, birds would appear to have no 'suprascapular' muscles at all, unless we may consider the deeper fibres of the praeglenoid head of the levator humeri in the emu and apteryx to represent such a muscle; for there is such a muscle in the crocodile, underneath the epicoraco-humeral and the deltoid, and supplied by the same nerve as the former of these muscles. It takes origin from the triangular surface (*ss*, fig. 1) intercepted between the

deltoid ridge, *d*, and the scapulo-coracoid fissure, and it is inserted just where the pectoral ridge sinks into the articular head of the humerus, proximally to the tendon of the teres minor. The supra-scapular muscle is not ordinarily differentiated in reptiles into an infra- and supra-spinatus. But in a gecko, *Platydactylus*, sp.?, I have observed it to take origin from the coracoid, as well as from the scapular region of the shoulder-girdle; and by doing this, it has brought itself by origin, as it is often by innervation, into close correspondence with the coraco-brachiales muscles, and, serially, with the iliacus of reptiles.

The muscle seen in fig. 4, intercepted between the tendon of the biceps and that of the pectoralis secundus, is called 'deltoides internus' by Meckel; it is, however, obviously homologous with an upper segment of the coraco-brachialis as seen in fig. 3 from the crocodile, and with the 'short coraco-brachialis' or 'rotator humeri' of Wood ('Journal of Anatomy and Physiology,' Nov. 1866, p. 49).

The muscle described by Mr. Mivart in the *Iguana tuberculata*, under the name of 'gracilis,' and stated by him to 'represent possibly the gracilis of mammals,' seems to me to be a serial homologue, which I have not met with elsewhere, of the pectoralis major. It arises from 'the ischiatic symphysis' (where, in the saurians, an ossific nodule, the os cloacae, may not rarely be found placed mesially, as though representing a sternum), and 'from the long tendinous arch which passes from the front of the acetabulum, round behind the pubic spine, back to the symphysis just mentioned.' This latter origin seems to me to correspond with the interclavicular and clavicular origin of the pectoral, as seen in some of the Sauropsida, and, as far as regards the clavicle, in mammals. Its insertion into the peroneal side of the head of the tibia seems to me to be paralleled by the insertion of the pecto-antebrachial of certain mammals, e.g. the cat (see Straus-Dürckheim, vol. ii. p. 352, pl. vii. figs. 13, 15). Mr. Mivart, by lettering his tibial adductor S, may be understood, perhaps, to mean that he considers this muscle homologous with the sartorius of anthropotomy; and in this identification I should coincide. But the gracilis, which he seems to think may perhaps be represented by the muscle I suppose to be homologous with the pectoralis major, I think must be represented by a head which the tibial adductor in the *Iguana tuberculata* examined by me received from the symphysis of the ischia.

Mr. Mivart's ilio-peroneal seems to me to have its serial homologue in the muscle which, in many mammals, passes from the posterior vertebral angle of the scapula down to the olecranon, and which seems to be a divarication of the more commonly found 'dorso-épitrochlien.' As this muscle is clearly one of the series made up of the biceps, semimembranosus, and semitendinosus, which, like itself, take origin, in Crocodilidae, from the ilium, it may be suggested that in the muscle just mentioned, as found in certain mammals, among which I may specify the marten (*Mustela martes*), may be contained the homologues of the biceps, semimembranosus, and semitendinosus, as well as the ilio-peroneal of the lower limb. This great increase of the number of the muscles of the lower, as compared with that of their homologues in their upper limb, is illustrated also by the great excess which the number made up by the adductores and the obturatores shows when compared with that of their homotypes the coraco-brachiales. It furnishes us with a fresh illustration of the principle laid down by Mr. Parker ('Shoulder-Girdle,' p. 7, note), to the effect that 'the hip-girdle is always, in the higher classes, more complete as to mere mass, and lower in type morphologically, than the shoulder-girdle.'

TABULAR VIEW OF MUSCULAR HOMOLOGIES SUGGESTED IN THIS PAPER.

Name of Muscle in Mammal.	*Homologue in Upper Extremity of Bird.*	*Homologue in Upper Extremity of Reptile.*	*Serial Homologue.*
Pectoralis major.	Ditto.	Ditto.	'Gracilis' of Mivart, as described, in *Iguana*, P. Z. S. 1867.
Pectoralis minor. Essentially the upper or anteriorly inserted fascicles of the deep layers of *pectoralis major.*	Ditto.	Fascicle lettered *ci* in fig. 3 ?	?
Subclavius. In mammals only is it of subordinate importance to the *spinati.*	*Pectoralis secundus s. levator humeri.*	*Epicoraco-humeral* of Mivart, as described in *Echidna* and *Iguana*, l.c. Amphibian *pars clavicularis deltoidei* as described by Ecker, *cleido-humeralis* of Pfeiffer.	Inner and deeper head of *pectineus*, supplied by obturator nerve.
Coraco-brachialis brevis s. rotator humeri of Wood.	*Deltoides inferior* of Meckel. No. xx. of Schoepss, Meckel's Archiv, 1829.	Upper part of *coraco-brachialis* lying superiorly to tendon of *biceps.*	Upper fascicles of *obturator externus.*
Coraco-brachialis medius. Coraco-brachialis longus.	*Pectoralis tertius s. coraco-brachialis inferior.* No. xvi. Schoepss, *l. c.*	Middle and longer portions of anterior *coraco-brachialis.*	Rest of *obturator externus* and adductors.

Name of Muscle in Mammal.	*Homologue in Upper Extremity of Bird.*	*Homologue in Upper Extremity of Reptile.*	*Serial Homologue.*
Deep portions of *coraco-brachialis*, in Monotreme. (See Mivart, p. 385, Linn. Soc. Trans. vol. xxv.)	*Coraco-brachialis superior.* No. xvii. Schoepss, suggested as homologue by Mivart, *l. c.*	Ditto.	*Obturator internus.* This muscle is never supplied by the obturator nerve.
Deltoid.	Represented in birds by the *deltoides externus* of Meckel, no. xix. Schoepss, by the *deltoides superior* of Meckel, no. xviii. of Schoepss, and by the smaller *levator humeri* of the fowl.	Deltoid.	Outer head of *pectineus*, supplied by anterior crural nerve or its internal cutaneous branch.
Infraspinatus and *supraspinatus.*	Not found in birds as differentiated slips.	*Supracapularis*, 'infraspinatus,' Mivart.	*Iliacus*, exclusively of part specified below.
Teres minor. Essentially a deep portion of posterior part of deltoid.	Not differentiated in birds, except emu and other Ratitae?	Differentiated in crocodile and chamaeleon.	*Musculus iliacus internus minor* of Luschka, Anat. Mensch. ii. 2. 131.
Scapulo-humeral. Essentially a part either of *subscapularis* or *teres major.*	Present in fowl, goose, sparrow-hawk, buzzard. Absent in pigeon.	Present in crocodile. Absent as a differentiated slip in some saurians.	*Musculus scansorius.*
Teres major.	Very large in birds.	Present in crocodile. Absent as differentiated slip in some saurians, as chamaeleon.	*Tensor fasciae femoris.*
Pyriformis.			In *Macropus major* a *thin* muscular slip arises from superior border of scapula near the origin of *omohyoid*. It passes down over the tendon of the *subscapularis*, with which muscle it is closely connected for an inch and a half, and it is also attached to the tendon of the *biceps* as it glides over the inner tuberosity of the humerus. It is inserted on the inner side of humerus above but close to the tendon of the *teres major*, overlying and giving fibres to the inner head of the *triceps*. This muscle corresponds with the iliac head of the *pyriformis*. The *acromio-trachelian* corresponds with its sacral head.
External and internal intercostal of anterior intercostal space.	'*Subclavius*' of birds.	*Subclavius* of reptiles.	External and internal intercostal muscles.
Biceps femoris. *Semimembranosus.* *Semitendinosus.*			Muscle arising from posterior vertebral angle of scapula, and passing down to olecranon. Lettered + t. in Cuvier and Laurillard's 'Planches de Myologie,' pls. 100, 104, 108.

Postscript, Dec. 11, 1868.

Several memoirs bearing more or less directly upon the subjects treated of in this paper have appeared, or at least come into my hands, subsequently to June 14th, 1868. First among them I may mention the paper on 'Variations in Human Myology,' which was read June 18th, 1868, before the Royal Society, by John Wood, Esq., F.R.C.S. In this paper, as published in the Royal Society's Proceedings, vol. xvi. no. 104, will be found an excellent figure of that common modification of the pectoralis minor which converts it into a more or less perfect levator humeri, so far as function is concerned. But that it was not a morphological equivalent of the pectoralis secundus of the bird would have been shown, I apprehend, first, by its relation to the costo-coracoid membrane, and, secondly, by its innervation. Meckel, in his 'Vergleichende Anatomie,' iii. p. 318, speculates as to whether the bird's 'pectoralis secundus' is to be regarded as a divarication of the great pectoral, or as a specialisation of a part of the deltoid. Now, as I hold that the pectoralis minor is essentially a part of the pectoralis major, I should say that Mr. Wood's figure shows that a levator humeri may be formed in the former of these two ways; and that such a muscle may be formed in the second of these two ways also is shown by the history I have already given, pp. 125, 126, of the smaller levator humeri in the fowl. But that the ordinary levator humeri s. pectoralis secundus of birds, which coexists with the smaller levator in the fowl, corresponds, *as a matter of fact*, to the epicoraco-humeral of the reptile and the subclavius of the mammal, is shown by the history of its relations to surrounding parts, by its nerve-supply, and by the history of the development of the great pectoral. Nor does functional correspondence enable us to argue to morphological identity here more than anywhere else.

Secondly, Professor Goodsir's 'Anatomical Memoirs' have, since last June, been published under the able editorship of his successor, Professor Turner; and in the first volume, at p. 452, may be found an exposition of the views of the late great anatomist, alluded to at p. 128, as to the 'morphology of the muscles of the limbs.' With reference to these views, I would remark that it seems incorrect to class the obturator internus with the subscapularis, because in

many birds there coexists, with a subscapularis, a 'coraco-brachialis superior' (no. xvii. Schoepss), which takes origin from the visceral surface of the coracoid bone and from the same aspect of the coraco-clavicular membrane. The tendon of this muscle may fuse with that of the subscapularis; and the bicipital muscle thus formed may receive its nerve-supply from a single nerve: but this nerve has never been observed by me to be the same as that which supplies the 'coraco-brachialis inferior' (no. xvi. Schoepss), any more than the nerve of the obturator internus is ever the same as that of the obturator externus. But it is plain that the coraco-brachialis superior must represent the obturator internus, and the subscapularis the gluteal muscle, which, as mentioned at p. 130, is so closely united with that obturator.

Neither can I coincide with the late Edinburgh Professor's comparison of the teres minor and infraspinatus to the gluteus minimus and medius—first, because I cannot but think that the musculus iliacus internus minor (see p. 134) is homologous with the teres minor, and, secondly, because I cannot consider the innervation of these upper-limb muscles to be in any way homologous with that of the glutei. The spinati and glutei do, it is true, resemble each other in attaining their greatest development in mammals; and the so-called 'gluteus maximus' and 'medius' of the Crocodilidæ (Dr. Hair, 'Journal of Anatomy and Physiology,' Nov. 1867) may be seen, by their innervation from the anterior crural, not to correspond to the similarly named muscles of mammals. But concomitant variation within the limits of a single class does not make two sets of muscles, with essentially different insertion and innervation, to be serially homologous.

Few anatomists would now deny that the os pubis is the homologue, not of the clavicle, but of the praecoracoid; but though I have myself accepted the comparison of the iliacus to the spinati, I should not so positively dissent from Professor Goodsir's comparison of it to the deltoid as I do from his other comparisons here specified.

But I may be permitted, perhaps, to say that the recti abdominis can scarcely be considered to form, as Professor Goodsir ranks them as forming, a class apart from the external and internal obliqui; for the arrangement of these muscles, as seen for example in the common fowl and the common pigeon severally, seems to me to

show that the rectus abdominis may be considered to be a specialisation in one animal of one, and in another of the other of these muscles. Neither is evidence wanting to show that the recti abdominis should, instead of being placed in a class by themselves, have the pectorales as well as the obliqui ranked with them[1].

Thirdly, a copiously illustrated memoir on the subject of this paper, 'Die Muskeln der vorderen Extremitäten der Reptilien und Vögel,' by Dr. Rüdinger, of Munich, has come into my hands quite recently. In it, however, I can find no views enunciated as to the homology of that most distinctively avian specialisation the pectoralis secundus. At p. 105, however, of this memoir I find a statement as to the muscles of saurians which confirms the view I had previously formed as to the homology of the muscular bellies which pass in certain animals (see p. 133) from the scapula to the forearm with the hamstring muscles of the lower limb. His words run thus:—'Nur erhebt sich zwischen dem lateralen Kopfe (des Triceps) und dem Deltoideus ein vom Schulterblatt *besonderer länglicher Muskel,* welcher da, wo gewöhnlich das Ligamentum intermusculare externum angebracht ist, nach unten gelangt, an der Beugeseite des Vorderarms Verstärkung erhält, und, theilweise mit der Aponeurose der am untern Ende des Humerus entspringenden Muskeln zusammenhangend, seinen Ansatz mit einer dünnen runden Sehne an der Beugeseite des Radius findet.'

Finally, I should add that I have strengthened the conclusions which I laid before the Linnean Society in June last by employing, as suggested to me at the meeting by Dr. Boycott, the evidence which may be drawn from the facts of innervation. But as this line of evidence has not, so far as I know, been touched upon in any other memoir upon this subject, I have not thought it necessary to keep the particular arguments which belong to it apart from the rest of the text.

[1] See Mivart, 'Proc. Zool. Soc.' June 27, 1867, p. 776; Meckel, 'Vergleich. Anatomie,' iii. pp. 155, 197; Ecker, 'Anatom. Frosches,' p. 95. See also the description of fig. 3, *e i*, on p. 138.

DESCRIPTION OF PLATE 3.

Fig. 1. Scapulo-coracoid arch of Crocodile (*Crocodilus vulgaris*).

sc. Scapula. *cr.* Coracoid. *gl.* Glenoid cavity.

bc. Facet of origin of biceps. Round this portion of the coracoid the head of the 'epicoraco-humeral' muscle which comes from the inner surface of the scapula winds.

pcr. Praecoracoid. The surface whence the coracoid head of the 'epicoraco-humeral' muscle arises extends from the point lettered *pcr* up to the line of fissure between scapula and coracoid, and a little beyond it.

d. Ridge on scapula, giving origin to deltoid. *tc.* Facet of origin of triceps.

ss. Surface of origin of supraspinatus. *cr f.* Coracoid foramen.

Fig. 2. Scapulo-coracoid arch of Emu (*Dromaius novae hollandiae*). Adult.

sc. Scapula. *cr.* Coracoid. *gl.* Glenoid. *pcr.* Praecoracoid.

cla. Line of clavicular abutment on scapula.

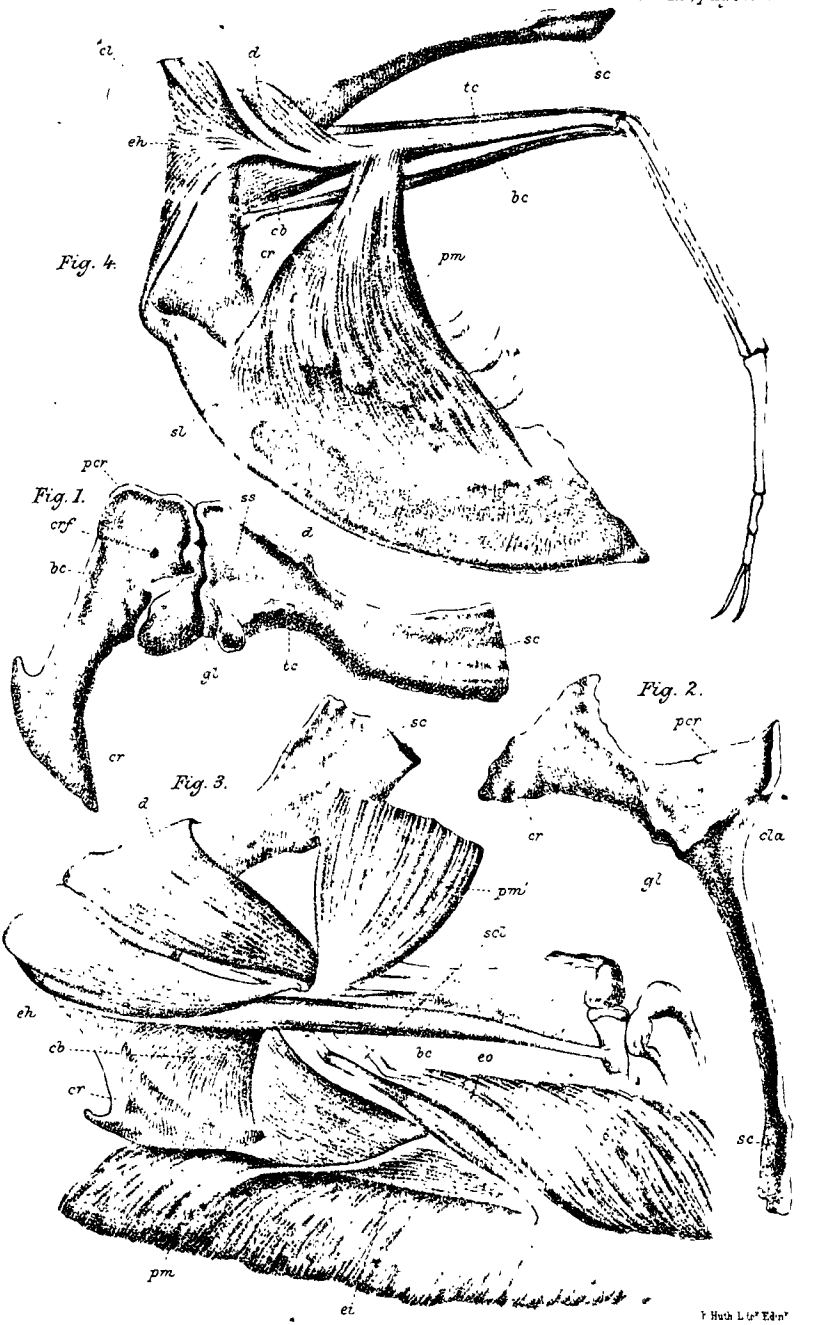
Between the points *pcr* and *gl*, and below *cla*, lies the praeglenoid expanse, made up by factors both from scapula and coracoid. From this expanse the coracoid head of the epicoraco-humeral muscle takes origin. The deltoid takes origin from the scapula immediately above and behind the line *cla*.

Fig. 3. Muscles in connexion with the scapulo-coracoid arch and upper extremity of Crocodile (*Crocodilus biporcatus*). The same arrangement has been noted in *Alligator lucius*, with scarcely any differences.

p m. Pectoralis major. The muscle has been divided, and its origin from the sternum and interclavicle turned mesially, and its tendon of insertion into the greater tuberosity of the humerus turned outwards. *p m'*, tendon of pectoralis major.

eh. 'Epicoraco-humeral' of Mivart ('Trans. Linn. Soc.' vol. xxv. 1866, p. 383), a bicipital muscle; its inner head winds round the coracoid face of the praeglenoid expanse, to take origin from the visceral surface of the scapula; its outer head arises from the praecoracoid, and, to a small extent, from the praescapular portion of the praeglenoid expanse, where it is in close relation with the deltoid. The inner of these two heads is intimately connected at its insertion with that of the pectoralis major, and, together with the tendon from the other head, occupies on the humerus a position between that of the tendon of the deltoid externally and inferiorly and that of the pectoralis major internally and inferiorly. The insertion of the omohyoid corresponds with the origin of the praeglenoid head of the epicoraco-humeral; and the fibres of the two muscles are, to some slight extent, continuous with each other, at least in young specimens.

e i. Muscular fascicle which arises from second sternocostal cartilage in the same series as the external oblique and intercostals, but which may also be looked upon as homologous with an anterior segment of the 'rectus abdominis,' which is often not distinguishable from the former of these muscles. It ends in a delicate tendon, which loses itself, along the coracoid groove, in the sternum and the origin of the pectoralis major. The rectus abdominis in many ordinary mammals has an insertion into the first rib (see Professor Turner, 'Journal of Anatomy and Physiology,' May 1868, p. 393), from which the ordinary mammalian subclavius arises; and in the order Monotremata it has, in both species of *Echidna* and in the *Ornithorhynchus*, an insertion into the coracoid at no great distance from the area of origin of their epicoraco-humeral, which I hold to be



F Huth Lith. Edin.

MUSCLES OF SHOULDER.

the homologue of the subclavius of other mammals. The prolongation of the tendon of this muscular fascicle (*ei*) may be considered to be due to the withdrawal of the Crocodile's epicoraco-humeral to the upper end of the coracoid. Finally, as the rectus is often fused with the pectoral, we may regard this fascicle as a nascent pectoralis minor.

eo. Muscular fascicle arising from the tip of the freely ending cartilage of the first thoracic rib (a point homologous with the points of origin of the several fascicles of the external oblique), and passing downwards and forwards to end in an aponeurosis attached mesially to the sternum and continuous with that of the external oblique. By contracting a close adhesion to the fibres of the anterior prolongation of the rectus abdominis instead of passing freely over them, as here, this muscular slip may, in other animals, as e. g. *Cynocephalus hamadryas*, assume the appearance of an outer head to this anterior prolongation. But its true character of homology with the fascicles of the external oblique is seen as plainly in the Guinea-pig (*Cavia aperia*) and the Aardvark (*Orycteropus capensis*), and, according to Meckel ('Vergleich. Anatomie,' p. 454), in the Raccoon (*Procyon lotor*) and in the Hedgehog (*Erinaceus europæus*), as it is here. In the Wombat (*Phascolomys wombat*) the true relations of this fascicle are very clearly seen; and a fascicle, obviously homologous with the one lettered *ei* in the Crocodile, passes from under it to join the subclavius arising from the first rib. This latter muscle arises, thick and fleshy, from the first rib in the Wombat, and is inserted into the outer end of the clavicle, and, by means of the fascia covering the supraspinatus muscle, into the whole length of the spine of the scapula. Before its insertion it is joined by a fine tendon from a delicate muscular belly, arising from the sixth costal cartilage, and homologous with the muscular fasciculus figured here at *ei*. Over this fascicle, which might be described in the Wombat as a second head of the subclavius, there passes inwards from the outer part of the first rib a muscular fasciculus, homologous with the one here figured in the Crocodile as *eo*, to end in a broad tendinous aponeurosis over the sternum, opposite the third and fourth costal cartilages. It is probable, on the whole, that this fascicle *eo* may be really the homologue of the muscular slip which is called 'rectus thoracis' by Professor Turner, *l. c.*, and which, as figured and described by him, appears to have a tendency to be produced obliquely inwards towards the sternum. (See 'Journal of Anatomy and Physiology,' May 1868, pp. 393, 394, *ibique citata.*)

scl. Subclavius or triangularis sterni muscle, the 'pectoralis secundus' of Haughton, and 'costocoracoid' of Mivart ('Proc. Zool. Soc.' June 1867, p. 776). Its superficial layer arises from the free cartilage of the second thoracic rib, and from the intermediate and sternal elements of the third and fourth thoracic ribs, and is inserted along the posterior edge of the coracoid. This muscle is obviously homologous with the similarly stratified muscle of similar origin and insertion in the bird, which is ordinarily called 'subclavius,' e. g. by Schoepss (Meckel's Archiv, 1829); but it cannot be homologous with the pectoralis secundus or levator humeri of the bird, inasmuch as the two muscles coexist with each other there. The same reasoning shows that it is not homologous with a pectoralis minor, though the slip which, in *Alligator lucius*, it gives to the muscle *ei* may be so in part.

cb. Coraco-brachialis, arising from anterior four-fifths of humeral edge of coracoid.

bc. Tendon of biceps, passing to be inserted on cephalic edge of coracoid.

Fig. 4. Muscles in connexion with the scapulo-coracoid arch and upper extremity of the Emu, *Dromaius novae hollandiae.*

p m. Pectoralis major. This muscle has a few fibres of origin in an aponeurosis

playing over the lower and outer angle of the coracoid; it arises also from the three anterior sternal ribs, and from a triangular space on the sternum, lying between the two other points of origin. It is inserted into the great tuberosity of the humerus by a tendon attached distally and internally to those of the epicoraco-humeral and deltoid.

eh. Epicoraco-humeral muscle. It arises from the mesial point of the sternum or 'rostrum' of the bone, from the coraco-clavicular membrane extending from the sternal rostrum up to the clavicle, and, thirdly, from an irregularly quadrangular praeglenoid headland, which, as verified in a young specimen, is constituted by scapula as well as by coracoid. It is inserted into the humerus a little proximally and internally to the deltoid, and superficially to the coraco-brachialis. It is obviously the homologue of the pectoralis secundus s. levator humeri of ordinary birds. (See Meckel on Anatomy of Cassowary, 'Meckel's Archiv,' 1830, p. 255. 5.)

bc. Tendon of biceps inserted into the humeral, and not, as in the Crocodile, into the cephalic edge of the coracoid. Between this tendon and that of the epicoraco-humeral or pectoralis secundus is seen the coraco-brachialis muscle, much reduced in size as compared with its homologue in the Crocodile. It has lost all the portion which arose mesially to the insertion of the biceps, and which Meckel called 'coraco-brachialis inferior s. pectoralis tertius,' and Schoepss, l. c., 'pectoralis *medius*.' Neither Schoepss nor Meckel seems (as far as the name 'deltoides inferior' can show, which they have given to the small muscle arising in ordinary birds from the lip of the coracoid underneath the tendon of the biceps, and inserted into the upper part of the great pectoral tuberosity) to have recognised its homology with the upper part of the coraco-brachialis muscle of the Crocodile and the coraco-brachialis brevis s. rotator humeri (Wood) of mammals. The only difference, however, between the muscle which Meckel and Schoepss call 'deltoides inferior' in the common Fowl and that which I have called in the Emu 'coraco-brachialis' is, that the larger biceps of the former animal has overlaid and stunted the muscle which the smaller biceps of the Emu has allowed to retain its reptilian proportions superiorly to its own insertion.

d. Deltoid, overlying and concealing from view a teres minor not found ordinarily in birds.

tc. Triceps.

XII.

NOTES ON THE POST-MORTEM EXAMINATION OF A MAN SUPPOSED TO HAVE BEEN ONE HUNDRED AND SIX YEARS OLD.

A MAN, reputed to have been in his 107th year, died at Oxford, on Thursday, September 11th, 1862. By the kind offices of Mr. Tyerman, who has published an account of his life[1], I was enabled to make a post-mortem examination of his body. From Mr. Tyerman's account of his life, I learn that he was born on the 5th of March, 1756; and that his father died at the age of 75, and his mother at 104, and his grandmother at 110.

Extra-anatomical discussion as to his age may be found in 'Notes and Queries,' April 12th, 1862, May 17th, 1862, June 17th, 1862; and a letter seriously impugning his claims to this lengthened term of years may be found in 'Jackson's Oxford Journal,' for September 27th, 1862. After making many enquiries myself, and after examining the evidence collected for me by my friend, A. B. Shepherd, Esq., of Brasenose College, upon the spots connected by tradition with the old man's early days, I have not been able to convince myself that one would be justified in rejecting as unfounded the statements as to his age which he himself uniformly and consistently made.

I am not clear that it is possible to bring conclusive evidence as to a single case, such as this, from the revelations of anatomical investigation. Sir Anthony Carlisle may not have been quite justified in saying that most aged persons die of actual disease in organs not worn out by the length of time they have been performing their functions; but his dictum was not so far from the truth as

[1] 'Notices of the life of John Pratt (now in his 106th year),' by Thomas F. Tyerman, Esq. Oxford, Slatter and Rose, 2 and 3, High Street. 1861.

to need more than partial modification. In the history of the examination of the body of an American physician who died at the age of 100, and about whose age I shall show there can be no reasonable doubt, I find the following statement:—'The bodies of very many persons at 60 exhibit on dissection more of the appearances which are thought to result from old age than did Dr. Holyoke's[1].'

An examination of the colossal tables given by Dr. Boyd in the 'Philosophical Transactions' for 1861, or of those reprinted by Dr. Peacock in the same year, will show how widely the weights and the measures of the same organs may vary within the same decennial period. And Dr. Geist[2], in the latest work treating of the diseases of old age with which I am acquainted, speaks of weighing and measuring as giving more extraordinarily varying results in very advanced years than in those which man more commonly attains to. Neither do qualitative changes of tissue give a more certain verdict. Cartilages may ossify[3], convolutions may waste[4], vessels, large and small, central and peripheral, may degenerate in young persons of particular habit, and habits, as well as in older individuals. For other reasons, however, much interest must always attach to records of the post-mortem appearances in the bodies of centenarians. A notice of the post-mortem examination of a woman[5], currently held to have been of that age, is given us by Haller: Dr. James Keill[6] has in like manner, and somewhat more fully, reported on the structures of John Bayles, who was believed, on apparently good evidence, to have been 130 years old. The history of Thomas Parr, and of the state of his body after 152 years of life, is accessible to all English readers in the Sydendam Society's edition of the works of the famous Harvey[7]. Two similar,

[1] 'Memoirs of Edward A. Holyoke, M.D., LL.D. Prepared in compliance with a vote of the Essex South District Medical Society, and published by their request.' Boston (U.S.), 1829, p. 53.

[2] 'Klinik der Greisenkrankheiten,' von Dr. Geist, Erlangen, 1860, p. 9. 'Gewichte und Dimensionen der Organe sind in hohen, noch mehr in höchsten Alters so ausserordentlich verschiedene und ungewöhnliche dass die gewöhnliche Beziehungen, gross, klein, schwer, leicht, *u. s. w.* eine Ausschauung nicht mehr begründen.'

[3] Humphry 'on the Skeleton,' p. 58.

[4] Reid's 'Anatomical Researches,' p. 383.

[5] 'Philosophical Transactions,' vol. xliv. p. 528, May 7, 1747.

[6] Ibid., vol. xxv. p. 2247. 1706.

[7] Harvey's Works, Sydenham Society, p. 589.

but less accessible, histories of the autopsies of persons whose more than centenarian term of years is very well nigh demonstrable, have been furnished to us by Dr. Luigi Berruti[1], in Italy; and in America by a committee of medical men, in the already cited case of Dr. Holyoke. To the case recorded by Dr. Berruti I shall recur; the case of Dr. Holyoke deserves a few words in this place. Dr. Holyoke, the subject of a memoir drawn up by a committee of medical men, had been himself a physician; and in the year preceding that in which he died, he twice appeared at public dinners, in his capacity of centenarian, in the town in which he had spent his life. In this town he had settled, at the age of twenty-one, in the year 1749, and from that time up to the time of his death, March 31st, 1829, he scarcely ever left it; and, in point of fact, never was further than fifty miles from it. With such a history as this, it is difficult to be sceptical as to Dr. Holyoke's age; and as he lived in possession of what are called the comforts of life, his case furnishes an answer to one of the most popular objections to the belief in centenarianism. This objection takes the following form. All the cases of supposed centenarians (such, indeed, are four of those I have instanced) are from the poorer classes, members of which often have a direct interest in making themselves out to be poorer than they really are. And it is exceedingly improbable, supposing such cases to be genuine, that the rich who die from the very same causes (climatic, epidemic, etc.) which the poor die from, should not furnish us with well-authenticated instances of such longevity as we are asked to believe is attained to by ill-clothed, ill-housed, hardly-fed labouring men. To this objection cases such as Dr. Holyoke's furnish a satisfactory reply, especially when we couple with them the consideration that the enormously larger numbers of the poor give Natural Selection an enormously larger chance of finding among them those 'vigorous frames which promise a long life.'

The details of the five cases I have mentioned I have kept in view whilst putting on record those observed by myself in the case of John Pratt.

Works on the diseases of age are by no means so numerous

[1] Luigi Berruti, 'Cenni istorici sopra Anastasio Melis di Gastegli in Sardegna, morto in età di anni 104 nello Spedale Mauriziano di Torino; con Osservazioni patho-logiche e necroscopiche.' Gaz. Med. Ital. St. Sardi, No. 35, 36, 37.

as works on the diseases of childhood. But one work on the subject, that by Dr. Geist already referred to, has appeared in Germany since the classical work of Canstatt[1], which latter was published in the now, for medicine, far-off times of 1839. France has shown equally little regard for the preservation and prolonging of waning lives; M. Durand-Fardel's work[2], however, bearing in French the date of 1854, and that of 1857 in a German translation by Dr. Ullmann[3], makes an honourable exception to the general neglect with which civilised, like savage, medicine seems to regard senile maladies. No work has appeared in England, so far as I can find, treating of this subject as a whole since Dr. Day's work in 1849[4].

The habits of the subject of this notice fell, I am informed, some way short of being strictly temperate; Mr. Tyerman's pamphlet and my own conversation with the old man make me rank his intelligence as somewhat superior to that usually possessed by persons in his rank of life; his memory of persons whose acquaintance he had recently made was tolerable, and of events as of persons known to his early years, it was, unlike that of Thomas Parr, even more accurate. I am informed by Cyril Vincent, Esq., of Oxford, that this old man had been receiving medical attendance for seven years. For the last two and a-half he has had the benefit of Mr. Vincent's personal attendance, his ailments being cough and the usual concomitants of hypertrophy and outgrowths of the prostate. An acute attack of pleurisy seems to have been the immediate cause of death, and the post-mortem examination will explain how cough had come to trouble him for a much longer period than this recent attack dated from. Like Cornaro in his enjoyment of a long term of vigorous healthy years, he resembled him also in sickness, by refractory and obstinate resistance to medical treatment.

[1] 'Die Krankheiten des höheren Alters und ihre Heilung.' Von Dr. C. Canstatt. Erlangen, 1839.

[2] 'Traité Clinique et Pratique des Maladies des Vieillards.' Par M. Durand-Fardel. Paris, 1854.

[3] Durand-Fardel, 'Handbuch der Krankheiten des Greisen Alters. Aus dem Französich übertragen und mit Zusätzen versehen.' Von Dr. Ullmann. Würzburg, 1857.

[4] 'A Practical Treatise on the Domestic Management and most important Diseases of Advanced Life.' By George E. Day, M.D. London, 1849.

Notes of Post-mortem Examination.

September 12th, 1862, 4.0 P.M., thirty-two hours after death; weather clear, not close:—

The rigor mortis was tolerably well developed, the fingers being bent in upon the palmar surface. There was no hair in either axilla, there was darkish coloured hair in no great abundance upon the mons martis, and gray hairs were thinly scattered over the scalp generally. The beard seemed to me the day after the post-mortem examination to have grown some little. Tongue was generally dry and slightly furfuraceous; some ecchymoses, like the blotches of scorbutus, were to be seen upon the back of the right hand. There was only one tooth in the jaws, the right upper canine. The scalp separated easily, and the pericranium was likewise easily detached from the subjacent cranial bones in the form of a dry, little vascular, coherent membrane. The cranial bones had a smooth and somewhat glistening surface. Well-nigh continuous tracings on the skull marked the position of the coronal and sagittal sutures. A broad and shallow depression, such as is often seen in well-developed crania, not such as Virchow has given the name of *sattelkopfe* to, crossed the skull in the line of the coronal suture. There was no exposure of Breschet's sinuses. There was an exostosis on the line of insertion of the temporal muscle upon the frontal bone. The skull bones were easy to be sawn through, the incisions being made, one parallel with and just in front of the coronal suture, and the other carried horizontally through the occipital protuberance, so as to meet the former just above, or in, the great ala of the sphenoid. There was much difficulty in removing the skull-cap, on account of the close adhesion of the dura mater; and in the process of removing them both, bone and membrane together, a considerable quantity of yellowish fluid escaped. The double cap thus removed brought away with it a portion of the pia mater, exposing a deep fissure between two convolutions; the convolutions were rounded, not flattened. Some little force was necessary to separate the dura mater from the cranial vault, which, however, was smooth internally, and presented only two or three small Pacchionian pits along its middle line. The canals for the middle meningeal arteries had had deep banks deposited on either side of them, and in places they were all but arched over,

showing that great additions had been made to the thickness of the cranium from within. The bone, when held up against the light, did not show any thinning, except along the course of these canals, where it was translucent. The relation of diploë and external and internal tables was much as in an ordinary skull. The anterior part of the falx cerebri was rigid, but not ossified; no exostoses were observed in the interior of the skull. I did not observe any sutures on the interior of the cranium, but I have no positive note of this absence, as I have of that of the exostoses not rarely found there in persons of advanced years. The foramen magnum was small, its antero-posterior diameter, when clothed with its membranes, admitted but the middle finger easily. The brain was tolerably firm; its weight, with the arachnoïd and pia mater adherent, was two pounds eleven ounces avoirdupois (43 oz.). The circumference of the skull, taken from the occipital protuberance round the supra-orbital ridges, was twenty and a-half inches; its vertical arc, measured from one external auditory meatus to the other, was twelve inches and a-half; these measurements were taken over the thin integuments of the cranium.

Some milkiness of colour was observable upon the arachnoïd where it crosses from one lateral lobe of the cerebellum to another, and upon the temporo-sphenoidal lobe of the cerebrum. A small clot of blood was observed in the basilar artery, the coats of which vessel were free from disease.

The fissure of Rolando, and the fissure anterior to it, were considerably wider and deeper than is usual; atrophy of the convolutions was observable, but to a less extent, in the frontal lobe; in the occipital, and upon the internal aspect of the hemispheres, no alteration had taken place. M. Durand-Fardel (p. xii. Op. cit.) gives this as the usual order in which atrophy of the convolutions and widening of the fissures takes place; and I have noticed a similar succession in the brain of a man beyond 70.

The application of M. Gratiolet's analysis of the convolutions to this brain enables us to speak of it as of no high morphological character. Though asymmetrical to a certain extent, it was yet less so than is usual in human brains, and in no part does it manifest any great complexity, as the hemispheres of men of marked intelligence ordinarily do. Mr. Tyerman's pamphlet, already alluded to, will enable a reader to form a tolerably fair estimate of

the mental powers of the subject of this notice; from my own personal acquaintance with him, I came to consider him as a little more than equal in intelligence to most men in his class of life. The result, however, of a similar comparison of the brains in either case would be expressed by exactly reversing this conclusion.

The cavity of the lateral ventricle was somewhat enlarged; its lining membrane, however, was smooth and unthickened; numerous amylaceous bodies were to be seen in microscopic slides taken from the surface of the corpus striatum and of the eminentia collateralis.

Von Baer[1] has suggested that the transverse coronal depression in the skull, noticed above, corresponds to a great development of the anterior and posterior genu of the corpus callosum of the contained brain. This anticipation may be said to be verified by the examination of the brain of John Pratt, for both the anterior genu and the posterior bourrelet of that commissure appeared remarkably large when compared with the corresponding structures in other brains.

In the only other instance with which I am acquainted of a record having been taken of the weight of the brain in a centenarian, the weight amounted to 45 ounces, exceeding that of John Pratt's by two ounces. For a note of this case, that of a woman of 100 years, I have to thank R. Garner, Esq., of Stoke-upon-Trent. This weight, it may be added, corresponds very nearly with that (45·34 ounces) given by Dr. Boyd[2] as the average of twenty-four brains from males about eighty years of age.

Though the body generally had the appearance of much, though not extreme, emaciation, there was yet a considerable layer of yellowish fat over the pectoral muscles and anterior body surface. The thoracic muscles looked thin and pale to the naked eye, but under the microscope their fibres showed the usual characters of striated muscle with very great clearness and distinctness: the same remarks apply to the diaphragm. The costal cartilages cut with the greatest ease, the line of demarcation between bone and cartilage was very well marked; the section of the cartilage presented a brownish-yellow colour, much like that of a decaying nut-kernel, to the naked eye; under the microscope the cartilage-cells,

[1] 'Die Makrokephalen im Boden der Krym und Oesterreichs,' p. 11.

[2] 'Philosophical Transactions' for 1861, p. 253.

mostly containing large oil-drops in their interior, were very plain, and numerous, and normal. There was much fluid in the right pleura; the lung was not adherent, but its lower lobe had a fringe of yellowish lymph along its edge, and the diaphragm had a coating of similar material, which presented the coarsely villous appearance assumed by lymph exuded between two opposed and moving surfaces. The apex of the right lung had strata of lymph of different ages and vascularity capping it, and a mass of consolidated tissue of the size of the second joint of the thumb underlay this portion of the pleura. This mass was of a dead white colour, a little variegated by the black pigment which abounded in both lungs; shreds of it sank in water, it had a small cavity with ragged walls in its interior, and it presented under the microscope the characters found in pneumonic consolidation. The black matter consisted of small granules of about the 12,000th of an inch, which were aggregated here and there into large masses. The left lung was universally adherent, the bands of attachment being old; there was a considerable amount of emphysema, as also in the right lung, along its anterior edge, but it was free from consolidation, and all, save pigmentary deposit.

The heart was much loaded with fat, which concealed the colour of the muscular tissue, over the entire surface of the right ventricle, and took the form of large bosses at the apex and round the base of the two ventricles. There was a considerable quantity of fluid in the pericardium, and some vascular injection upon the intra-pericardial part of the aorta, as if from commencing inflammation. Its circumference there was four inches. White spots of thickened serous membrane were visible upon the aorta and pulmonary artery, as well as upon the usual places on the anterior surface of the right ventricle, and upon the back of the heart.

The valvula Thebesii in the right auricle and the remnant of the Eustachian valve were large and stout; and the difference between the colour of the two auricles was as sharp as usual. A linear aperture, guarded by a valvular flap, looked downwards from the fenestra ovalis into the right auricle; a moderate-sized probe passed easily through this into the left auricle, from under a flap of half-an-inch in length, attached at both ends, and looking downwards also. The cusp immediately next the conus arteriosus was considerably thickened; from the conus arteriosus, close to, but not connected

with one of the columnae carneae of this cusp, arose a moderator band, and passed to the anterior wall of the ventricle. In the apex of the right ventricle there was a very complex reticulation of columnae carneae unconnected with the valves; a similar but less complex arrangement existed in the apex of the left also. Of the pulmonary valves there is nothing to be said, and of the mitral and aortic, merely that there was a little atheromatous discoloration upon them, and that the latter seemed a little larger than usual. There was a good deal more atheroma arranged on the aorta in a line opposite the free edge of the aortic valves, and at one spot a considerable calcareous deposit was mixed up with it. But on the aorta beyond there was very little more of this deposit; but a single patch, in fact, in a length of vessel of as much as 2½″ from the aortic valves. All the atheromatous and calcareous deposits alike were covered by the internal coat of the vessel, which was easily stripped off them in a continuous longitudinally fibrous sheet. There was no such deposit observable in the pulmonary artery; there was no clot in any of the cavities of the heart. Under the microscope the transverse striation, and even the branching of the heart fibres, were very clearly observable; but parallel with most or all the fibres, oil-drops of a yellowish colour, soluble in ether, were arranged in a moniliform fashion.

The liver was pale. Hepatic congestion was observed. Some yellow bile was seen in the ductus choledochus communis, which did not seem larger than usual. The weight of the liver was the same as that of the brain—viz. 2 lb. 11 oz. Under the microscope it was seen to be gorged with oil, every cell containing one or two large drops.

The spleen was very small, its weight two ounces, its capsule tuberculated.

The stomach and intestines presented little which was abnormal. There was no thinning of coats, or dilatation or narrowing of the calibre of any portion of the tube; the lowest part of the tract contained a quantity of well-elaborated faecal matter.

There were no mesenteric glands to be seen in the layers of the mesentery; and Peyer's glands were represented to the naked eye by black specks merely. But these latter glands, on being placed under the microscope, presented just the same appearance of turgescence and roundness that they would have done in a younger

subject. Though the nodes on the stem of the lymphatic or lacteal tree had shrivelled and disappeared, the spongioles on its roots were still active. The statements in Haller's 'Disputations[1],' as to the total disappearance of the mesenteric system in advanced age, needs, therefore, certain qualifications, which our modern knowledge of the true nature of the Peyerian glands enables us to make.

Both ureters were greatly dilated, and there was an abundance of reddish-yellow grains of uric acid in the pelvis and calices of the right kidney, as well as throughout the bladder. These concretions of uric acid were seen under an inch-power to be multi-tuberculate, or rather spinose, on their exterior; they were of the size of coarsish sand. The weight of the right kidney was $2\frac{3}{4}$ oz.; that of the left, which was somewhat deeply imbedded in fat, was $2\frac{1}{4}$ oz. Exteriorly, both kidneys had indications of lobulation, and numerous small cysts, as in the case of Parr, scattered over their surface. Microscopically, the kidney tissues seemed normal. The bladder had risen so far out of the pelvis as nearly to abut upon the promontory of the sacrum. Its increase of size was due to the hypertrophy of its coats, and especially of its muscular coat. Everywhere, except over the trigonum vesicae, the mucous membrane was bulged into sacculi prolonged between the muscular bundles for a depth of as much as a quarter of an inch, the orifices of communication between them and the general cavity of the bladder lying transversely to its vertical axis. Just at the commencement of the urethra, on the right side of the veru montanum, a pediculate growth, the size of a pea, projected into the urethra; on reflecting the mucous membrane, another similarly attached but smaller tumour was discovered close by the pedicle of the first; and on the left side of the veru montanum a broad and flat tumour, as large as both those of the right side taken together, was found, separable from, but, like the two pediculate tumours, possessing the same microscopic characters and prostatic corpuscles as the subjacent glandular isthmus or 'middle lobe.' The orifices of the prostatic glands were large. The prostate figured by Sir

[1] 'Disp. Anat.,' vii. p. 77. 'Constat glandulas mesentericas maximas et pulcherrimas in foetu esse, sed imminui pro aetate crescente, *ut in senio evanescant omnes*. Ita Ruyschius senex de se ipso scripsit per multos nunc annos nulla sibi superesse vasa lactea, quod quidem non nisi ex experimentis et observationibus didicit, quibus constat anno septuagesimo et prius glandulas mesentericas omnes evanuisse.'

Everard Home in the second plate of his second volume upon the diseases of this gland must have resembled the one just described very closely. The lateral lobes were large, and in the veins forming the prostatic plexus some little blood was observed, but by no means a large quantity.

A uterus masculinus of one-third of an inch was present; the vasa deferentia opening anterior to it, one on either side.

A semi-lunar fold of mucous membrane of three-eighths of an inch in length projected on either side of the veru montanum from the lateral lobe of the prostate, with its free edge towards the membranous part of the urethra. Some yellowish fluid was contained in the spermatic vesicles and ends of the vasa deferentia; it contained a great number of free nuclei, but no spermatozoa.

The scrotum was not opened, but I could not detect any testes within it, though the epididymis was easily recognisable within either compartment. Dr. Davy was informed by the old man, in the summer of 1861, that it was not till the age of 100 that he lost virile power, and that it was then his health began to fail. This coincidence of failures seems in accordance with the conclusion come to by Dr. Davy, in his 'Anatomical and Physiological Researches,' vol. i. p. 337, to the effect that, with the exception of consumption, wasting diseases terminating in death have the effect of arresting the spermatic secretion. M. Duplay[1], however, who examined the contents of the seminal vesicles in 51 cases of old men, and found spermatozoa in as many as 37 of these cases, these 37 being mostly above 70 years of age, remarks that nearly half of them died of chronic diseases, and that some modification of Dr. Davy's views seems necessitated by his statistics. That Thomas Parr retained virile power to the age of 100 is only too well known; and in the 'Derby Mercury' for November 12, 1862, I find an account of a congratulatory dinner given to a centenarian, Mr. Foster, whose 'firstborn child, if now living, would have attained her seventy-eighth year; and whose last, the only one left, had celebrated her tenth birthday but a few days before.'

Dr. Luigi Berruti's recently published account of an Italian who died at the age of 104, besides furnishing a singularly close historical parallel to the case of Thomas Parr, shows us that the

[1] Geist, 'Klinik der Greisenkrankheiten,' vol. i. p. 147; 'Archives Générales de Médecine,' Dec. 1852, 1853; Schmidt's 'Jahrbücher,' 1853, No. 4; 1856, No. 2.

Sardinian lancet is employed with the same murderous impartiality against ecclesiastics, as we knew it to be against princes and statesmen. The case is to be found, somewhat abridged by Professor Kussmaul, in Canstatt's 'Jahresbericht' for 1857, Band ii, Allgemeine Pathologie, pp. 46, 47; and as, whether in the Italian original, or in the German report, it is not accessible to all English readers, there is the more reason for giving it *in extenso*.

A. Melis, born 1753, at Gastegli, in Sardinia, lived for forty years as a minorite brother in Spain, till, in consequence of the political troubles there, he was expelled thence, with some other clergy, and returned to Sardinia. There he obtained a small benefice. He was of a very jovial temperament, and took pleasure in having his affairs go on after a fixed and settled plan. He was of middle size, strongly built, and of a good digestion; fond of the pleasures of the table and of good wine. Every now and then he complained of feeling himself full-blooded, languid (*eingenommen*), and of diminished appetite; and upon such occasions he betook himself to purgatives and bleeding. In his lifetime he had submitted himself to *some hundreds* of bleedings. He often made short journeys on foot or on horseback, and he loved hunting. Victor Emmanuel II. wished to see the old priest of 104. Melis made a journey of some days through Sardinia on horseback, then took ship for Genoa, and on arriving at Turin had an old woman of 107 introduced to him. He was much fêted there, in spite of the old man's adage—'Young man, if thou goest so fast, thou wilt never grow old;' and he surfeited himself, laughing and boasting about his iron constitution, on cheese, tunny, and wine. He was attacked by pneumonia, and *in spite* of three bleedings, of which one amounted to nearly nine ounces (250 grammes), purgatives, and so forth, he died sixteen days after his admission into the hospital.

The curly black hair of the head and the teeth were in perfect preservation; the body was very muscular and very fat. There was slight rigidity of the limbs twenty-four hours after death. The bones of the thorax were very fragile, the costal cartilages quite ossified, the diploë and sutures of the cranial bones had disappeared. The dura mater was beset here and there with bony plates. The basilar and vertebral arteries were ossified, and there were incrustations on the aortic valves, on the aorta itself, and on many of its

branches. The heart was very fat, its muscular tissue firm; there were blood-clots on its interior. There was splenization of the lung and bronchitis (*sic*). In the other organs of the body there was nothing worthy of note. Melis's parents had, like himself, attained great ages. The post-mortem appearances put on record by Dr. Berruti coincide in scarcely a single particular with those I have noticed in John Pratt. Ossification of the cartilages is noted in this case and in that of Dr. Holyoke; in the cases given by Haller, Dr. Keill, Harvey and myself they were not thus altered. That the immoderate use of alcoholic drinks may lead to this change, even in young subjects[1], cannot be doubted; still, as Dr. Holyoke led a life of the greatest temperance, the ossification of his costal cartilages must have been owing to some other cause. Old age causes very opposite changes to take place in bone; possibly it may act upon cartilages in equally differing ways.

The appearances noted in the case of John Pratt coincide with those recorded in the case of Thomas Parr, in the following particulars. In both, the stomach and intestine-walls were of normal firmness and thickness; in both, the spleen was very small; in both, the outer surface of the kidney was beset with serous cysts, and that of the heart with fat, and in both the costal cartilages retained their softness. In this last point, as well as in that of the dilatation of the aorta, Haller's and Dr. Keill's cases resemble that of John Pratt. Dr. Keill's case affords a yet more perfect parallel by the state of the right kidney, of the spleen, and of the pigment-spotted lungs. In this last point, as in that of the condition of the testes, Parr differed from Pratt.

Dr. Holyoke has left us a graphic account of the sensation of fluctuation within his head, which led him to suspect the existence of what has been called hydrocephalus *ex vacuo*. The post-mortem examination verified his diagnosis. In this point, as well as in that of pigmentary deposit in the lungs, in those of abundant deposit of fat round the heart, of bloodlessness of the scalp, of widened cerebral fissures, and of cysts upon the kidney's surface, the case I have here recorded coincides with that of Dr. Holyoke.

None of the appearances recorded in the post-mortem of John Pratt are inconsistent with the claim he made to the age of 106; the many points, indeed, in which they resemble the appearances

[1] Humphry 'On the Human Skeleton,' p. 58.

noted in persons undoubtedly centenarian, may, by the very fact of their being many, lend some probability to it. Taken singly, they have little weight, their evidence is cumulative. Perhaps even standing alone, the diminution of the mass of the blood and of the blood-making organs—the spleen and the mesenteric glands—may be considered as some proof of great age.

The dilatation of the aorta and the outgrowing of the prostate are frequently, yet not constantly nor exclusively, noticeable senile changes. The pathological alterations which the heart, lungs, liver and kidneys had undergone impair any evidence which might possibly have been based upon their weights.

The pancreas I did not weigh, through inadvertence[1]. Many other omissions will be noted in my account of this examination; some, however, such as that of the weight of the body, were owing, not to inadvertence, but to other causes, which I need not specify.

[1] I may say that M. Durand-Fardel is wrong in saying (l. c. p. xxi), 'Le pancréas est, suivant Canstatt, *de toutes les glandes* celle dont la métamorphose atrophique s'observe *le plus souvent chez les vieillards*.' Canstatt's words are, 'Atrophische Verwandlung in hohen Alter *nicht selten ist*.' (Tome i. p. 69.) This correction may, I hope, save some one certain trouble, which M. Durand-Fardel's erroneous statement caused me to undertake.

XIII.

ON THE VARIOUS FORMS OF THE SO-CALLED 'CELTIC' CRANIUM.

Professor Nilsson, eighteen years ago, declared that he considered nothing more vague and uncertain than the form of the Celtic cranium[1]; and Professor Ecker[2] has expressed himself in much the same language as to the Roman cranium: the latter of these two authors, however, has done much towards removing some of the uncertainty of which he complains. Upon these two points I should wish here to make a few remarks. Under the head of pre-Roman skulls, found in Britain, most writers would be agreed that three distinct types may be classed—as the 'River-bed' type of Professor Huxley, the brachycephalic type of Dr. Thurnam, and the dolichocephalic 'pre-Celtic type' of the same author. I have to say that a dolichocephalic cranium, distinct from the dolichocephalic Celtic cranium found in the long barrows, exists in addition to these three types, with the latter of which, I believe, it is sometimes confounded. Representatives of this type of crania may be found in a cast in the easily accessible Museum of the London College of Surgeons, and in another cast, made by Dr. Thurnam, and now widely circulated, of a cranium procured by me, through the kindness of J. C. Athorpe, Esq., from a barrow near Dinnington, in South Yorkshire; and, finally, in no less than thirty-two crania or calvaria, which the inexhaustible civility of William Aldworth, Esq., has enabled me to procure from an all but equally inexhaustible cemetery on his estate at Frilford. First, of the cast in the College of Surgeons; in the Catalogue of the Osteological Series it may be found described thus at No. 5709: 'A plaster cast of

[1] 'Crania Britannica,' Letter to Dr. Thurnam, p. 17.
[2] 'Archiv für Anthropologie,' bd. ii. hft. i. 110.

the cranium of an ancient aboriginal of Scandinavia regarded as the Celt. The cranium is long in proportion to its breadth, and resembles in size and shape the Gentoo skull, No. 5553. This is the type of a class of skulls called dolichocephalic by the donor, Professor Retzius.' Secondly, of the Dinnington cranium, I would remark that Professor Ecker, in 'Archiv für Anthropologie,' bd. i. hft. 2. p. 283, has remarked of it, that it is exceedingly like the Frankish skulls obtained by him from his grave-row cemeteries. And Dr. Barnard Davis, in his 'Thesaurus Craniorum,' p. 10, speaks of it as 'a very large, even enormous, subscaphocephalic skull.' Of the thirty-two crania obtained by me from Frilford, which from archaeological evidence detailed by me in a paper to be published by the Society of Antiquaries[1] have been shown to belong to pre-Saxon times, I may say, firstly, that they resemble very closely the two casts already mentioned; and, secondly, that they differ from the dolichocephalic crania ordinarily obtained from long barrows, and notably from such crania obtained for me, by the agency of the Rev. David Royce, from a long barrow at Netherswell, near Stow-on-the-Wold, as much as any two sets of dolichocephalic crania can differ. Their frontal region though not loftier is yet fuller and wider; and much the same description may apply to every other part of the calvarium, which in no point corresponds to the description given by His and Rutimeyer to their Hohberg type of skull, except that occasionally in male skulls, though by no means always, it has the mesial vertical carina, developed in male specimens (cf. Professor Ecker, 'Archiv für Anthropologie,' bd. i. hft. 1. p. 84). The skulls themselves, whether belonging to young or old, present signs of culture in the softness and even rounding of their outlines, to which the retention of verticality by the forehead presents an exception in subordination to the rule or reason of the absence of angles elsewhere, but if the skulls themselves differ their owners seem to me to have differed much more. Of all differences which relate to life there is no one more important than difference as to its duration, and in this the British crania of Frilford differ most essentially and to great advantage from the dolichocephalic individuals described by Dr. Thurnam, in 'Memoirs of Anthropological Society of London,' vol. i, as found by him in dolichotaphic barrows. Eleven, or more than half of twenty-one, male

[1] See Article XXXIV. of this volume.

crania, obtained by me from Frilford, I have classed as aged; it is needless to say that this very high average of senility is as characteristic of a state of civilisation as the surroundings of the tenants of long barrows are of barbarism; secondly, the average height of these individuals was 5 ft. 8·3 in., whereas the average height of the dolichocephalic Britons from long barrows is given as 5 ft. 6 in. Finally, the dolichocephalic Celt, whose distinctness I am advocating, survives to the present day, and I am a little doubtful whether as much can be said for his rougher dolichocephalic representative. I am aware that there are points of resemblance, as well as points of difference, between these two types; and I am also aware, and indeed would suggest, that the points of difference may be referable to differences of culture. But within the limits of any one species, whether vegetable or animal, brute or human, differences produced by culture seem to me as great as any other. It is in favour certainly of their kinship, that they appear, both of them together, in the same cemetery, as at Dinnington; whereas neither of them has ever been found by me so interred as to make it seem probable that their owners ever occupied one area simultaneously and in peace with the brachycephalic British Celt. There are several explanations for this fact, if fact it be; I leave them to what the Germans would call the *Willkühr* of the historian. I will just remark that anthropologists, in whom the tendency I have just mentioned is little less marked, have observed that a certain furrow or *rainure*, which Von Baer has noted in the Aleutians (see 'Crania Selecta,' p. 265 (25)), and I have seen in Eskimos, is, according to their *Willkühr*, sometimes characteristic and sometimes not (Pruner Bey, 'Bull. Soc. Anth.,' 'Of the Celt,' Paris, 1863, and M. Bonté, 'Bull. Soc. Anth.,' Paris, 1864, vol. v). I can only say that it sometimes is and sometimes is not found in these crania, and that its presence or absence seems to me to depend simply upon the necessity which the posterior parts of the parietal bones may or not be under to accommodate themselves to the requirements of a growing or not growing brain, whilst under no circumstances are their apposed portions, underlaid by the longitudinal sinus, under any obligation so to accommodate themselves. It is, I apprehend, in a somewhat similar way that the presence of a transverse, wide, and shallow furrow, a little way posteriorly to the coronal suture, is to be explained, as

it very often is, in well-developed skulls ('Med. Chir. Review,' April, 1863, p. 508). In well-developed human brains the posterior parts of the upper frontal [1] convolutions, as also the lobule of the second ascending parietal convolutions, are largely developed; whilst the first ascending convolution and the fissure of Rolando (Thurnam, 'Nat. Hist. Rev.' 1865, p. 267) remain as lines of indifference between them, along which no stimulus is propagated to the outer pericranium, and no absorption of the tabula vitrea inside excited. Both the posterior coronal furrow and the furrow at right angles to it in the posterior portion of the sagittal suture are present, though but faintly indicated, in the Dinnington cast I have spoken of.

It is not beside the purpose to add here that Retzius ('Ethnologische Schriften,' p. 108, 1864) distinguished these two varieties of Celtic crania from each other as emphatically as I have striven to do. After describing a long narrow and laterally compressed skull, which he says is specially found in England and France, and which obviously corresponds to the ordinary long barrow or Hohberg type, he says, 'Nevertheless this is not the common Celtic form, which is ordinarily somewhat broader and not so compressed, whilst the "Cimbric" Celtic form, which is here and there found in South Sweden and Denmark, is somewhat broader still. This form is very like the Scandinavian Gothic.' Both these forms of crania seem to me to be different from the Roman form of cranium which may be seen figured from Maggiorani in Von Baer's paper on the Rhaetians in the 'Bull. Acad. Imp. Sci. St. Pétersbourg,' 1860, p. 58. This form of cranium however I am enabled to say, a specimen from the Towyn y Capel tumulus having been presented to the University Museum by the Hon. W. O. Stanley, coexisted with the River Bed type in this island, just as this latter coexisted and apparently peacefully with Retzius' 'Common Celtic' form in the Frilford cemetery, and with the 'Brachycephalic Celt' form of Dr. Thurnam in a barrow at Crawley. Finally, the platycephalic Roman form as figured and described by Maggiorani and Sandifort (Ecker, 'Crania Germaniae,' p. 86) is very precisely and abundantly represented in the series obtained by me from the barrow at Dinnington, where it coexisted with both the longer forms of Celtic crania. Of this barrow, as it is now so

[1] See Marshall, 'Phil. Trans.' 1863, p. 513.

frequently referred to, it may be well to put here on record such notes as I have been able to gather from the report of persons present at the removal of the stones of which the barrow was made up, and from personal observations made upon the spot where it had been, after its removal.

Dinnington is a small village about two miles south of Laughton-en-le-Morthen (in the Moorland) in South Yorkshire. A little to the south of Dinnington and on the left hand of the road leading from Dinnington to Anston, and some little way short of the quarries from which the stone for the New Houses of Parliament was taken, there was on the estate of J. C. Athorpe, Esq., a heap of stones about 134 paces in circumference, 42 long, and 35 or a little less in breadth, and 7 or 8 feet in height. The stone was the light porous sandstone common in the neighbourhood; the individual pieces were of nearly equal size throughout; and there was no protecting lean-to nor cist anywhere in the tumulus. Up to 1862 the tumulus was covered with turf, had thorn shrubs growing upon it, and had rabbit burrows in it. In the autumn of that year Mr. Athorpe began to dig away the turf and stub up the thorn bushes, and finally to cart away the stones for wall-building. It was in doing this that the workmen came upon the skeletons, of which there were in all as many as twenty-two, twelve lying in the centre of the cairn, near to each other, but not piled one upon the other, and without any orientations, ornaments, weapons, flints or pottery. Some of the skeletons were at as great a depth as 12 feet, one skeleton, however, was no deeper than 2½ feet. The workmen said, 'the skulls lay between the legs; 'the thigh-bones were at the back of the neck;' and I suppose consequently that the bodies had been buried in a sitting posture. Only one skeleton was extended, and its head lay at the north-west. The barrow itself had its long diameter, which however was only the longer by a very few yards, and may have become so by virtue of the paring to which it may have been subject in agricultural processes, lying east and west. At its east end a skeleton was placed far apart from the rest, a point of importance to be noted, as Sir R. C. Hoare (cit. 'Crania Britannica,' i. p. 230) has put on record that the deposit in the long barrows he excavated was usually at the east, which was also the broader end. A considerable proportion of these skeletons had belonged to aged indi-

viduals, and from this as from other circumstances detailed above, the hypothesis of a battle will not account for the facts of these burials. Many of the skulls possess the subquadrate general outline combined with smoothly swelling and elegantly rounded individual contours which are described as characteristic of the Roman cranium; and the locality renders the admixture of Roman soldiers by no means an impossible supposition. I am not acquainted, though professed archaeologists may be, with any account of a cemetery exactly resembling this in Great Britain; but the following account which Weinhold gives ('Sitzungsberichte Kaiser. Akad. Wien. Phil. Hist. Class.,' 1858, bd. xxix. hft. 1. p. 166) of a variety of grave mounds found in Germany and containing unburnt bodies may be compared advantageously with the imperfect account I have given above of the Dinnington tumulus. His words are, 'Manchmal vermisst man an den aufgedeckten Gerippen die gewöhnliche sorgfältige Behandlung der Todten; sie scheinen nur nachlässig hingelegt oder hingeworfen. (Keller, "Grabhügel in Burghölzli bei Zürich; ebd. Helvet. Heidengräber und Todtenhügel," 16). Wenn die Gebeine völlig über einem Haufen liegen, wie in einem Tumulus bei Biewer in Luxemburg und einem Heidenbuck bei Ossingen im Thurgau, wird man annehmen müssen, dass der Todte sitzend bestattet wurde; in beiden Fällen zeigt das Grab nicht die mindeste Spur einer späteren Störung. ("Publicat. Soc. Hist. Luxembourg," vii. 106; Keller, "Helvet. Heidengräber," 18).'

The skeletons after the removal of the stones which had covered them were reinterred in the earth, and it was only after the second disinterment that, through the kindness of the owner of the soil, they came into my hands.

XIV.

ON THE WEDDO OF CEYLON.

Professor Rolleston exhibited in 1872 to the British Association, Section of Biology, ten photographs of the Jungle Weddo, taken by B. F. Hartshorne, Esq., as also three skulls of the same tribe procured by the same gentleman, and some skulls of certain Kolarian tribes procured by H. Duthoit, Esq., of Mirzapore, and exhibited for the sake of comparison with those of the Ceylon aborigines. There was no doubt about the genuineness of the three Weddo skulls; yet one of the three was as markedly brachycephalic (the cephalic index being 81) as the others, or as Weddo skulls usually, were dolichocephalic. The cephalic indices in the two other skulls, procured from the district of the Jungle Weddo, a tribe now numbering, in all probability, little over 100 persons, were 70 and 76. In three other Weddo skulls, two of which had been obtained by Lieutenant Perkins for Canon Greenwell, and the third had been presented by Mr. Sabonnadiere to the Oxford University Museum, the cephalic indices were respectively 72, 68, and 64. The cubic capacity in each of the two dolichocephalic crania sent by Mr. Hartshorne was 85·25 cubic inches and 80 cubic inches respectively; the cubic capacity of the single brachycephalic specimen was, approximatively, 69 cubic inches. It was of importance to note that synostosis could have had nothing to do with the bringing about of the aberrances of the brachycephalic Weddo cranium, for the coronal suture was open whilst the sagittal was obliterated, the very condition which, if the shape of the skull had ruled the shape of the brain instead of the reverse, would have produced dolichocephaly. The presence of parietal occipital flattening on the left side (a deformity unintentionally produced during early life by the mode of carrying the infant) was also noteworthy as being rarely observed except in brachycephalous skulls. With reference to the

large question of the affinities of the Dravidian races of Continental India to the Weddo of Ceylon, Professor Rolleston referred to the papers on Indian Ethnology in the 'Journal of the Ethnological Society,' July 1869, by Sir Walter Elliott, George Campbell, Esq., Dr. Campbell, and others.

[Professor Flower has given in his Osteological Catalogue of the Human Crania in the Museum of the Royal College of Surgeons of England the measurements of eight crania said to be Veddah or Weddo skulls. Four of these specimens have been described by Mr. George Busk in the 'Proc. Linn. Soc.' 1862. The cephalic indices of these crania presented a great range of variation, from dolichocephalism to brachycephalism. The mean of the eight specimens was 72; whilst the maximum cephalic index was 83 and the minimum 67.—EDITOR.]

XV.

DESCRIPTION OF FIGURES OF SKULLS OBTAINED BY CANON GREENWELL FROM BRITISH BARROWS WHICH HE EXAMINED[1].

ELEVEN skulls and two calvariae from thirteen barrows examined by Canon Greenwell have been selected for description by myself, and drawn and engraved by Mr. W. H. Wesley. Four of the skulls and both the calvariae are of the dolichocephalic, and the remaining seven of the brachycephalic type. Four views have been given of each of the eleven skulls; the incomplete state of the two calvariae rendered it useless to attempt to give more than two views of each of them. The four views given are the profile view, the so-called norma lateralis; the view from above, the norma verticalis; the view from in front, the norma frontalis; and the view from behind, the norma occipitalis. Views have not been given of the norma basalis, the base of the skulls having very ordinarily suffered so much posthumous injury as greatly to impair the value of such a view of them.

Each skull has been drawn in the position most commonly adopted by craniographers, in which a vertical line drawn from the centre of the auditory meatus passes through the plane of the junction of the coronal and sagittal sutures[2]. The horizontal plane obtained by drawing a line from the centre of the auditory meatus at right

[1] [The barrows are described in 'British Barrows,' Clarendon Press, Oxford, 1877.—EDITOR.]

[2] For the most recent Memoir which has appeared upon the question of the true horizontal plane of the human skull, see 'Archiv für Anthropologie,' Bd. ix. 1876, 'Die horizontal Ebene des menschlichen Schädels, von Dr. Schmidt in Essen.' To the extensive bibliography there given should be added a reference to Professor Busk's Address to the Anthropological Institute, January 1874 (given in Journal of Institute, vol. iii. p. 522), where especial reference is made to Dr. von Ihering's views upon the subject which have been put forward by him in the 'Archiv für Anthropologie,' vol. v. 1872, and the 'Zeitschrift für Ethnologie,' 1873. See also Aeby, 'Archiv für Anthropologie,' vol. vi. p. 295, 1874; Gosse, 'Déformations artificielles du Crâne,' pp. 7, 59. 1855. In brachycephalic skulls with vertical foreheads the true vertical line often falls a little way behind the coronal suture.

angles to this vertical line will pass at a slightly variable distance above the floor of the nostrils, and will be found ordinarily, though not invariably, to be parallel with the horizontal plane which would be obtained from a consideration of the visual axis, or from the direction of the fronto-ethmoidal suture as proposed by Professor Goodsir[1], or from a horizontal surface touching the skull at its occipital condyles and at the posterior border of its occipital foramen, as proposed by Professor Cleland[2].

The principal measurements taken have been :—

I. Measurements of Calvaria.

Extreme length.	Cubical capacity.
Fronto-inial length.	Frontal arc.
Extreme breadth.	Parietal arc.
Vertical height.	Occipital arc.
Absolute height.	Minimum frontal width.
Basi-cranial axis.	Maximum frontal width.
Circumference.	Maximum occipital width.

II. Measurements of Face.

Length of face : 'naso-alveolar' line.
Breadth of face : interzygomatic line.
'Basio-subnasal' line[3].
'Basio-alveolar' line.
Height of orbit.
Width of orbit.
Length of nose.
Width of nose.
Lower jaw, interangular diameter.
Lower jaw, depth at symphysis.
Lower jaw, width of ramus.

III. Indices.

Length-breadth index : 'cephalic index.'
Antero-posterior index.

Where any of these measurements have been omitted, it will be understood that the damaged condition of the skull prevented them from being taken.

It will be well, as some differences exist in the practice of craniographers as to the exact points whence their measurements are taken, to specify, in cases where such differences have existed, what the points are whence and to which the measurements given in the subjoined descriptions have been taken.

[1] 'Anatomical Memoirs,' 1868, vol. i. p. 247, Edinburgh.
[2] See 'Phil. Trans.' vol. clx. p. 121, 1870.
[3] For explanation of the words 'Basio-subnasal' and 'Basio-alveolar' see p. 168 *infra*.

The 'extreme length' has been taken neither from the fronto-nasal suture, as Professor Virchow takes it[1], nor from the 'glabella' strictly so called, i.e. from the interspace separating or connecting, as the case may be, the two supraciliary ridges, but from a spot immediately above that area—just, in fact, where the upper part of the frontal begins to rise into it. This appears to be the most reasonable spot to take for an antero-posterior measurement of the brain-case, as the applied arm of the compasses comes there into nearer relations with the cavity containing the cerebrum than at either of the two other points specified. The most posteriorly placed part of the skull, whatever it may be short of an exaggeratedly developed occipital spine, is the point to which the other arm of the compasses is applied for this measurement. This point will sometimes be found at the base and on the upper surface of the external occipital 'spine,' or 'protuberance,' or 'inion,' in cases in which the superior occipital squama is flat and takes a perpendicular direction: and here what may be called the 'fronto-inial' diameter is identical with the 'fronto-postremal' or extreme length of the skull. It is usually in brachycephalic skulls that this is the case; it is however by no means rare in the dolichocephalic forms. Sometimes, as in the more typical dolichocephalic skulls, the most posteriorly placed point of the skull is to be found upon the superior squama occipitis, which in these cases is as markedly convex as in the other class of cases it is markedly flat; and here a difference, which may amount to as much as half an inch, may exist between the 'fronto-inial' and the extreme length. This difference has been considered to furnish a measure of 'occipital dolichocephaly[2],' or of the extent to which the posterior cerebral lobes overlap the cerebellum. It must be remarked, however, that in some skulls, where we find the occipital spine taking the form of a broad transversely running ridge, in which the lineae supremae[3] of Merkel are fused with the lineae superiores nuchae, the slightness of the difference between the two cranial measurements in question may cause us to under-estimate the extent of the cerebral overlap,

[1] 'Archiv für Anthropologie,' vol. iv. p. 59, 1870.

[2] For 'Occipital dolichocephaly,' see Gratiolet, Bullet. Soc. Anth. Paris, ii. p. 254, 1861; Broca, ibid. iv. pp. 49–56, 1863, or his collected Mémoires, ii. p. 27, 1864; British Association Report for 1875, p. 152.

[3] For explanation of these terms, see Dr. Fr. Merkel, 'Die Linea nuchae suprema,' 1871.

and that, except in those rare cases in which the 'fronto-inial' diameter can be taken to a 'tuberculum linearum' as distinguished from a 'protuberantia occipitalis externa,' it is always necessary to compare the internal with the external surface of the skull.

The extreme breadth has in these skulls been taken upon the parietal bones, either in 'well-filled' skulls at some point abutting upon the posterior edge of the squamous portion of the temporal bone, or in 'ill-filled' skulls at the tuberosities. The squamous portion of the temporal has very frequently in old skulls become separated a little from the parietal, and it is rendered consequently unfit to be taken as a surface to measure from. The extreme breadth therefore being always the extreme parietal breadth, it has been unnecessary to have a separate entry for this as for the corresponding frontal and occipital diameters.

The anterior margin of the occipital foramen has been frequently so much injured in these ancient skulls as to render it impossible to take their actual or 'absolute' height from the plane of the foramen magnum. In these cases the so-called 'upright' height of Professors von Baer [1], His [2], and Ecker [3], taken by placing one arm of the beam-compasses upon the posterior border of the occipital foramen and at right angles to a vertical line passing from the middle of the auditory foramen to the junction of the coronal and sagittal sutures, and the other upon the most distant part of the cranial vault, becomes of especial importance. This measurement is, of course, somewhat greater than that of the 'actual' or 'absolute' height as usually taken from the plane of the foramen magnum —a point to be borne in mind when we compare the height and breadth of these skulls with those dimensions in other series.

The imperfect state of the skulls has similarly rendered it impossible in many cases to take the measurements of the basi-cranial axis, or of the cubical capacity.

The minimum frontal width has been taken from a spot immediately behind the external angular process of the frontal bone, and below the temporal ridge on one side, to the corresponding spot on the other. The maximum has been taken between two points below the temporal ridge at the coronal suture.

[1] 'Zusammenkunft einiger Anthropologen,' p. 50, Leipzig, 1861.
[2] 'Crania Helvetica,' p. 7, 1864.
[3] 'Crania Germaniae Meridional. Occident.' p. 3, 1865.

The maximum parietal width is, as stated above, given under the head of 'Extreme Breadth;' the maximum occipital is taken from the point ('asterion' of MM. Broca and Topinard) where the occipital, parietal, and temporal bones of one side meet, to the corresponding point on the other; i.e. between the two most distant points of the lambdoid suture.

It is not unusual to give a number of 'indices' stating the proportions existing between various measures of length in addition to that usually called the 'Cephalic Index,' which gives the relation of the breadth of the calvaria to the length taken as 100. Thus we have an index of the relation of the height to the length and of the height to the breadth; a 'nasal index;' an 'orbital index;' and a 'maxillary[1] index,' giving the relations of the basi-cranial line to a line passing from the middle of the anterior border of the foramen magnum, the 'basion' of Broca, to the nasal spine. The value of these measurements is beyond question; but as the important point in each of these cases is simply one of greater or less magnitude, oscillating within narrow limits, the inconvenience of additional statements of proportion is not counterbalanced by much corresponding advantage. I have, however, given one measurement of proportions in addition to the 'Cephalic Index;' and this, which I have called the 'Antero-posterior Index,' gives the relation which is held to the extreme length of the skull by that part of the extreme length which lies anteriorly to the auditory foramen. The extreme length being taken as above described, it is divided into an anterior and a posterior segment by a line passing as a tangent to the anterior border of the auditory meatus, and prolonged so as to cut the line of extreme length at right angles. The proportions between these segments may be very readily obtained by fitting an indicator to one of the longer sides of M. Broca's '*cadre à maxima*[2],' and, when the instrument is so applied as to take the extreme length, adjusting the indicator so as to run as a tangent to the anterior edge of the auditory meatus. The vertical line thus obtained falls always some way behind the junction of the coronal and sagittal sutures; but though

[1] Virchow, 'Archiv für Anthropologie,' vol. iv. p. 63, 1870.

[2] For description of this useful instrument, see 'Bulletin Soc. Anthrop. Paris,' tom. iv. (2de Série), pp. 101–104, 1869; or 'Mémoires d'Anthropologie par Paul Broca,' tom. i. p. 152, 1871.

it fails thus to coincide with the vertical line chosen for placing the skull in for the purpose of drawing, it does coincide very nearly with the line which might be drawn across the external surface of the cerebral hemisphere for limiting posteriorly the area which is most favourably conditioned as to irrigation with arterialised blood. The segments therefore into which it divides the line of extreme length may be held to correspond respectively to more and to less favourably nourished and actively operating segments of the cerebral hemisphere, and the statement of their relative proportions as expressed in the 'Antero-posterior Index' assumes considerable importance.

The indications as to prognathism and its absence furnished by the 'maxillary index' of Virchow and the 'gnathic index' of Busk ('Journal Anthrop. Instit.' London, Jan. 1874, p. 496) are both easily obtained by comparison of the three measurements, (a) of the basi-cranial axis taken from the middle of the anterior border of the occipital foramen, the 'basion' of Professor Broca, to the fronto-nasal suture; (b) of the 'basio-subnasal' line measured from the 'basion' to the base of the nasal spine; and (c) of the 'basio-alveolar line' measured from the 'basion' to the edge of the alveolar process of the upper jaw. A fourth facial measurement, that of the length from the fronto-nasal suture to the edge of the alveolar process of the upper jaw, which may be called the 'naso-alveolar' line, together with the three others just given, enables us to construct two 'facial triangles.' In some cases where the anterior margin of the foramen magnum has been wanting, the facial angles, with apices respectively at the base of the nasal spine and at the fore-edge of the alveolar border of the upper jaw, have been taken by Professor Broca's 'Nouveau Goniomètre,' described and figured in the 'Bullet. Soc. Anth. Paris,' t. v. 1re Série, 1861, pp. 943–946, or in his collected 'Mémoires d'Anthropologie,' tom. i. pp. 106–109, 1871 [1].

The stature has usually been calculated from an estimate of the length of the femur as being 27·5 to 100 of the entire length of the body. By another method, that of adding the lengths of the femur and tibia together, multiplying by two, and then adding an inch for the calcaneal integument, we obtain sometimes an

[1] For alveolar prognathism and its linear measurement, see Topinard, 'L'Anthropologie,' p. 303, 1876, and Sasse, 'Archiv für Anthropologie,' ix. p. 9, 1876.

identical, sometimes a slightly lower stature-estimate. The length of the femur has been measured[1] from the point at which the head of the bone abuts upon one flat surface to the middle point of another flat surface which touches the distal ends of both the condyles. The length of the tibia has been taken from the level of the femoral articular-surface to that of the astragalar, as by Professor Huxley, l. c. p. 146, and Langer, l. c. p. 65. In some few cases, in which none of the other long bones were available for measurement, the length of the humerus, from the upper surface of its head to the middle of the distal articular surface, has been taken as being 19·5 to the stature as 100, as given by Professor Humphry, 'Human Skeleton,' p. 108, 1858.

As regards the sex of the skulls described and figured, there can, it is believed, be little ambiguity even irrespectively of any indications which the long bones and pelvis may have afforded. These indications have of course always been taken into account, where it was possible to do so, in the determination of the sex, not only of each figured and described skull, but also of every other skull mentioned in this book which has been sent to me for verification. In some cases[2] it may be unsafe, in the absence

[1] This measurement, as taken by Professor Huxley ('Prehistoric Remains of Caithness,' p. 147), appears to be preferable for the purpose in question to that taken by Virchow ('Archiv für Anthropologie,' vol. vi. p. 18) from the trochanter major to the external condyle; or by Liharzig, from the same point to the middle of the patella ('Gesetz des Wachsthums,' p. 321, 1862); or by Langer ('Wachsthum des Menschlichen Skelets,' Denkschrift Kais. Akad. Wiss. Wien, Math. Nat. Klass., Bd. xxi. S. A. pp. 59, 87), from the apex of the trochanter major to the middle of a line drawn as above as a tangent to the two condyles; or by Lissauer ('Alt-Pommer. Schädel,' p. 8, 1872), from the uppermost point of the head of the femur to the under edge of the inner condyle.

[2] The skull of an Anglo-Saxon woman found by me at Frilford ['Archaeologia,' vol. xvii. p. 440, 1870], buried with the insignia of the female sex, would I think be referred to the male sex by most craniologists if the bones of the trunk and limbs (to say nothing of the archaeological surroundings) had not been available for reference and comparison, as fortunately they were and are in the University Museum, 'No. xxii. Jan. 6, 1869.' Similarly I have more than once had skulls of savage races put into my hands which I had every reason to believe had belonged to females, but which, from a consideration of the skull-characters alone, I should have supposed to have belonged to men. As I have elsewhere observed, however (see 'Journal of Anthropological Institute,' vol. v. p. 123, October 1875), female skulls of savage races are by no means always thus similar to male either in size, texture, or contour; the class of cases indeed characterised by similarity or subequality is perhaps only a little more numerous, at all events amongst priscan skulls, than the class characterised by disproportionate smallness. As Welcker has observed ('Archiv für Anthropologie,'

of the bones of the trunk and limbs, to pronounce as to the sex of a skull, and it is much more unsafe, as the disputes relative to the Engis skull show, to pronounce positively in cases where the lower jaw and even the base of the skull with the mastoids and the facial bones are wanting also. When such cases have occurred amongst the skulls submitted to me, I have spoken of the sex as 'uncertain;' this uncertainty however does not seem to me to attach to any of the figured skulls or calvariae.

The skulls which have been selected for figuring will put into contrast not only the peculiarities of male and female crania, but also those due to differences in years; special regard having been had in their arrangement to the importance of distinguishing between ethnical characters and those dependent upon age by ranking the skulls of each type in the order of their seniority.

vol. i. p. 127, 1856), the cases where ambiguity arises are cases in which female skulls have assumed, or must be supposed to have assumed, male characters; it is only very rarely that we are in any danger of supposing a skull to be female which is really male. On the other hand, the words of His ('Crania Helvetica,' p. 9, 1864), 'Die Geschlechtsbestimmung nach dem blossen Ansehen führt allzuleicht zu Willkührlichkeiten als dass man sich darauf verlassen könnte,' seem to me to rate the value of an unassisted cranioscopy in the question of sex a little lower than it really deserves. And the argument by which he supports this view, drawn from the fact that skulls which had been claimed by competent observers as undoubtedly female could nevertheless be proved to have come from an interment on a battlefield, is by no means convincing. The German woman was told (see Tacitus, 'Germania,' p. 18), on the occasion of her marriage, by tangible symbols as well as by mere words, 'venire se laborum periculorumque sociam, idem in pace, *idem in praelio passuram ausuramque*.' The same community of risks, we are told by numerous ancient writers, e. g. Diodorus[1], Strabo[2], Plutarch[3], and others, was run by both sexes amongst Celtic tribes; and I find it recorded of a Celtic invasion[4], which took place little more than 200 years ago and ended much as the one just referred to as recorded by Plutarch, that 'amongst the Welsh were found many women which had knives near half a yard long to effect some notable massacres with them.' Mr. W. P. Price has enabled me to prove the truth of this statement by an examination of the skeletons of these invaders.

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[1] Diodorus, v. 32. *Αἱ δὲ γυναῖκες τῶν Γαλατῶν οὐ μόνον τοῖς μεγέθεσι παραπλήσιοι τοῖς ἀνδράσιν εἰσὶν ἀλλὰ καὶ ταῖς ἀλκαῖς ἐνάμιλλοι.*

[2] Strabo, vii. 2. 3. *Ἔθος δέ τι τῶν Κίμβρων διηγοῦνται τοιοῦτον ὅτι ταῖς γυναιξὶν αὐτῶν συστρατευούσαις παρησυλούθουν προμάντεις.*

[3] Plutarch, Marius, 27. The details of the slaughters of Aquae Sextiae and Vercellae are too well known to need quoting: 'nec minus cum uxoribus eorum pugna quam cum ipsis fuit,' says Florus, iii. 3. See also Ammianus Marcellinus, xv. c. 12.

[4] 'The Kingdome's Weekly Intelligencer,' Friday, March 31, 1643; a Parliamentarian newspaper, quoted in a 'Letter on the Discovery of the Skeletons at Barber's Bridge,' by W. H. Price, Esq., M.P. Gloucester, 1868.

The following works and memoirs may be consulted as to points distinguishing male from female crania:—

Humphry, 'Human Skeleton,' 1858, pp. 103–232.

Von Baer, 'Crania Selecta,' Mém. Acad. Imp. St. Pétersbourg, tom. viii. 1859, p. 259.

Welcker, 'Wachsthum und Bau des Menschlichen Schädels,' 1862, pp. 65, 141. 'Archiv für Anthropologie,' Bd. i. 1866, pp. 110 and 120–127. B. Davis, Ibid., Bd. ii. p. 25.

Ecker, Ibid. p. 82, and Bd. ii. p. 110, 1867, and 'Crania Germaniae Meridionalis Occidentalis,' 1865, p. 78.

Aeby, 'Schädelformen,' 1867, pp. 10–12. 'Archiv für Anthropologie,' vi. 1872, p. 302.

Cleland, 'Phil. Trans.' 1870, pp. 124–132, 161–164.

Weisbach, 'Archiv für Anthropologie,' Bd. i. 1866, pp. 191 and 285. 'Archiv für Anthropologie,' Bd. iii. 1868, p. 61.

With tables such as those given by Dr. Aitken, 'On the Growth of the Recruit,' 1862, pp. 36–38, and by Welcker, 'Archiv für Anthropologie,' i. p. 119, 1864, there is very little difficulty in determining with a high degree of probability the age of skulls below 30 years of age, if the bones of the trunk and limbs are available as well as the cranium. This, however, has by no means always been the case with the skulls of this series; still the condition of the teeth furnishes us with a fair indication for an approximate estimate of the age of their owner up to the age mentioned. When the teeth all alike have begun to show marks of wear, but the inner and outer surfaces of the skull still retain some smoothness and glossiness, I have spoken of the skull as belonging to a person in the 'early portion of middle life,' meaning thereby a period from 30 to 40. Greater wear of the teeth as yet unaccompanied with serious senile changes I have spoken of as characterising 'later middle life,' a period between 40 and 50. The commencement of senile changes I have noted by speaking of the skull as having belonged to a person 'past middle life,' their greater development by speaking of the skull as that of an 'aged' person. In priscan, as indeed, according to Dr. E. Zuckerkandl ('Reise der Österreich. Freg. Novara,' 1875, p. 117), in modern skulls, both of civilised and savage races, the obliteration of the sutures of the skull takes place at any time within a period extending over no less a time than the twenty years from the age of 20 to that of 40. Dr. Thurnam

showed ('Nat. Hist. Rev.' April 1865; 'Mem. Soc. Anth. Lond.' vol. iii. 1867–9, p. 70; see also Virchow, 'Archiv für Anthropologie,' v. p. 535, 1872) that the British, like some other dolichocephalic skulls, had a great tendency to premature obliteration of the main sutures, and these facts have been kept in view in making estimates of the ages of the skulls, and especially of the calvariae, which have been put into my hands.

For a description of senile changes in the cranium, may be consulted Welcker, 'Archiv für Anthropologie,' i. p. 119, 1866; Virchow, 'Verhandlungen Phys. Med. Gesellschaft zu Würzburg,' iv. 354, 1853, 'Ueber die Involutionskrankheit (Malum senile) der platten Knochen, namentlich des Schädels,' or 'Gesamm. Abhand.' p. 1010 sqq., 1856; Lucae, 'Schädel abnorm. Form,' xiii. and xiv, p. 31, 1857; and Cleland, 'Phil. Trans.' pp. 136, 160, 162, 1870.

The 'basilar angle' of Professor Broca, taken in the manner recommended by him ('Revue d'Anthropologie,' ii. 2. p. 202, 1873; 'Instructions Craniologiques, Mém. Soc. Anth. Paris,' tom. ii. 2de Série, 1875, pp. 90–93, or Topinard, 'L'Anthropologie,' pp. 54, 307, 1876), has been added to some of the lists of measurements. It expresses well in the inverse ratio of its numbers the greater or less extent of the cranial curvature or antero-posterior arch described by the cerebral hemispheres. Its *rationale* is well illustrated by such figures as those given by Ecker, 'Archiv für Anthropologie,' iv. 1870, p. 301, fig. 39, p. 303, fig. 40, and by the figures in the two plates appended to that paper, 'Ueber die verschiedene Krümmung des Schädelrohres und über die Stellung des Schädels auf die Wirbelsäule beim Neger und beim Europäer.' The same indication is given in a less precise way by placing a skull with the grinding surface of its upper-jaw teeth upon a flat surface and then observing whether it is the occipital condyles or the conceptacula cerebelli which furnish a support to the back part of the skull when it is brought down on to that surface. This method however of estimating the extent of cranial curvature is not rarely likely to mislead us. For in skulls of adults, and especially of male adults, the occipital condyles are often found to have increased considerably in a downward direction; and such skulls may then come, when placed as above directed, to rest upon them, owing, not to any deficiency in the cranial curvature or length of the brain, but simply to this outgrowing of the condyles which is developed in aid of the maintenance of the balance of the

head in the horizontal position, as pointed out by Professor Cleland, 'Phil. Trans.' 1870, p. 161.

Of the several normae, the norma lateralis or profile view of a skull is the most important, giving as it does, firstly, the most characteristic view of the upper and lower jaw, secondly, the relation of height to length, and, thirdly, the picturesque peculiarities of the antero-posterior curve of the cranial vault[1]. The upper contour line, in fact, of a brachycephalic skull viewed in profile, dipping away, as it does, more or less abruptly downwards in a plane but a little posterior to that of the parietal tubera, distinguishes such a skull from dolichocephalic forms as sharply as the proportion seen, in its vertical norma, to be borne by its transverse to its longitudinal diameter. The possession in fact of such a contour line may justify us in considering a skull to belong to the brachycephalic division and in speaking of it as 'brachycephalic by contour,' even though its extreme breadth may bear a less favourable ratio than that of 80 to 100 of its extreme length.

It may be well to state here that the 'precipitous sinking' away of this contour line is very frequently due to an abrupt curvature of the parietal bones exclusively; and that, contrary to what has sometimes been laid down, the superior occipital squama may be 'full and globular' in a brachycephalic skull, standing out in a plane posterior to that occupied by the posterior portion of the parietals, and constituting thus what has been called a 'capsulires Hinterhaupt[2].'

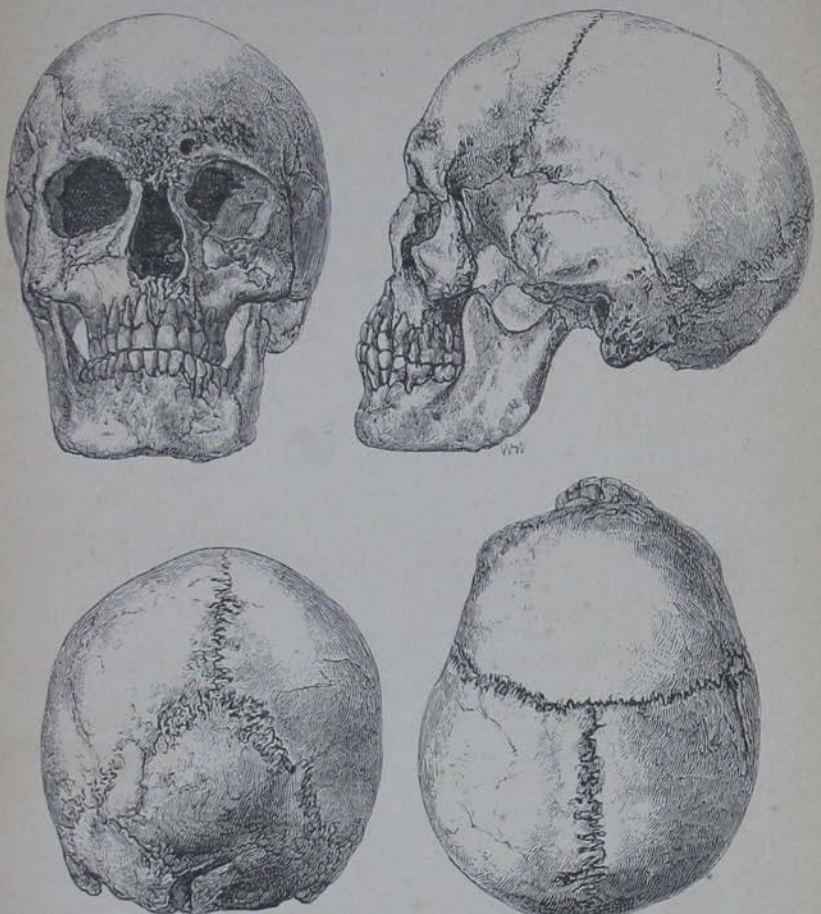
Further, if it is incorrect to speak of flatness of the superior squama occipitis as being characteristic of brachycephalic crania, it is equally incorrect to say the like of the inferior squama forming the conceptacula cerebelli, or to say that tumidity of this region is characteristic of female skulls. For male brachycephalic skulls very frequently have their conceptacula cerebelli prominently convex outwardly, as the great relative and absolute height of such skulls and the great downward pressure of their cerebral hemispheres would have led us to expect.

[1] Cleland, 'Phil. Trans. 1870,' p. 145, and Retzius, 'Ethnolog. Schriften,' pp. 118–121, cit. in loco.

[2] Virchow, 'Archiv für Anthropologie,' iv. 84, and note to p. 177 *infra*.

WEAVERTHORPE.

[xlvi. 1, p. 200[1].]



SKULL OF A MAN BETWEEN TWENTY AND TWENTY-FOUR YEARS OF AGE AND 5 FT. 8 IN. IN STATURE.

[1] [These, and the corresponding numerals on the succeeding pages, refer to the number of the barrow and the page in 'British Barrows,' where it is described.—EDITOR.]

I. Measurements of Calvaria.

Extreme length	7·2″	Frontal arc	5″
Fronto-nasal length	7″	Parietal arc	5″
Extreme breadth	5·8″	Occipital arc	4·9″
Vertical height	6″	Minimum frontal width	3·9″
Circumference	20·8″	Maximum frontal width	4·7″

II. Measurements of Face.

Length of face: 'naso-alveolar' line	2·6″
Breadth of face: 'interzygomatic' line	5·2″
Facial angle to nasal spine	77
Facial angle to alveolar border	73
Height of orbit	1·3″
Width of orbit	1·5″
Length of nose	1·9″
Width of nose	1·0″
Lower jaw, interangular diameter	3·6″
Lower jaw, depth at symphysis	1·3″
Lower jaw, width at ramus	1·5″

III. Indices.

Length-breadth index: 'cephalic index'	80
Antero-posterior index, approximatively	51

This skull and the one next to be described (Flixton Wold, lxxi. 5[1]) belong respectively to a young man and a young woman of the brachycephalic type, and of about the same age, viz. from twenty to twenty-four years of age, the age and the sex both having been determined by an examination of the trunk and limbs as well as of the cranial bones. They may be taken therefore as good illustrations of the form of the brachycephalic type in early maturity, as the skull Heslerton Wold, p. 181, may be taken to illustrate this type in the earlier portion of middle life; the skulls 'Ilderton,' 'Cowlam, lix. 3,' and 'Rudstone, lxiii. 9,' its form in the later periods of middle age; and 'Castle Carrock, ccxiii. 1,' its peculiarities as modified by senile changes.

The owner of this skull must have been a young man of very great muscular strength, the femur being flanged out into a large flat process anteriorly to the upper part of the insertion of the glutaeus maximus, and the linea aspera attaining similarly large proportions, though traces of the anchyloses of its head and epiphyses are still visible. It may be remarked that Dr. Hölder, in his description[2] of the brachycephalic type at present existing in Würtemberg, and called by him the 'Ligurian,' says that in them the upper third of the femur is flattened from before backwards, but it may be doubted whether this peculiarity has any morphological value.

[1] [The Roman numerals here and elsewhere in this description refer to the number of the barrow in 'British Barrows.'—EDITOR]

[2] 'Archiv für Anthropologie,' ii. p. 54, 1867.

I have noted it in skeletons of dolichocephalic individuals who could not have been of any very great muscular development, except possibly as regards the particular muscle named. The cristae ilii and the ischial epiphyses are not yet perfectly anchylosed, though they still adhere to the os innominatum. One wisdom tooth only has come into actual use, the other three being still in their alveoli. The basi-cranial bones are lost, and nothing therefore can be said as to the closure of the spheno-basilar suture. Viewed in the norma lateralis, the dip in the parieto-occipital region, though more abrupt than it would be even in a female specimen of the dolichocephalic type, is yet a little more oblique, not only than are female, but also than we shall find the more mature brachycephalic males to be. The forehead has the obliquity so frequent in strong male skulls of every type, and, contrary to what is usually laid down[1] as to young skulls, the frontal sinuses are already largely developed, and, as is usual in this type, separated from each other by a broad and shallow glabellar furrow.

The lower jaw contrasts by the height of its coronoid relatively to the zygomatic arch, and by the form of its chin as well as by the measurements given above, with the female skull, Flixton, iii. 6, next to be described, illustrating herein the principle that sexual as well as other characters are often as distinctly recognisable in the lower jaw as anywhere else in the skeleton. The larger size of the mastoids is well seen in the skull on the side not shown in the drawing; the large size of its air-cells is, however, well shown on the injured side figured. There appears to have been some right parieto-occipital flattening, due probably to the carrying of the owner of this skull when an infant with the head supported on the right side; and this distortion[2] appears to have been increased by

[1] Broca, 'Mémoires d'Anthropologie,' vol. i. p. 76. Mr. Prescott Hewett, 'Medical Times and Gazette,' p. 106, Aug. 4, 1855, says these cavities do not begin to develope till the fourteenth or fifteenth year. In some of these early skulls, however, I have seen them largely developed as early as when the first true molar has only just come into use.

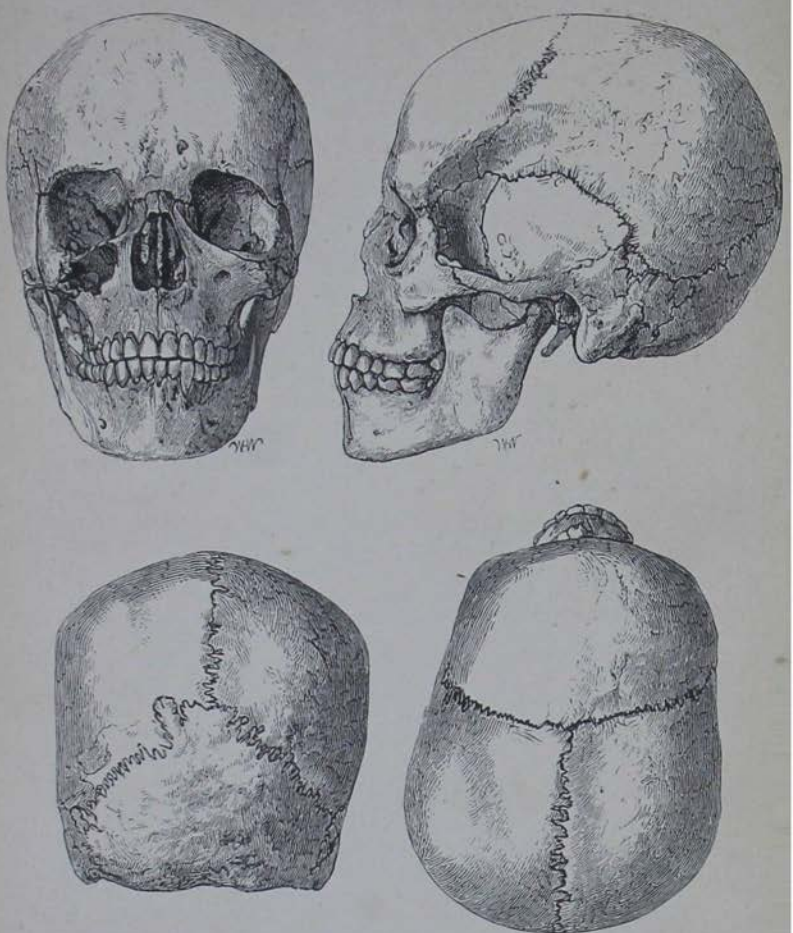
[2] The following observations made by Vesalius in 1543 ('De Corporis Humani Fabrica,' lib. i. cap. 5. p. 16, tom. i. Opera Omnia, Leyden, 1725) as to the production of artificial though unintentional cranial deformation bear on this point and some others raised at the present moment: 'Germani vero complesso plerumque occipitio, et lato capite spectantur, quod pueri in cunis dorso semper incumbant ac manibus fere citra fasciarum usum, cunarum lateribus utrinque alligentur. Belgis oblongiora caeteris propemodum reservantur permanentve capita, quod matres suos puerulos fasciis involutos in latere et temporibus potissimum dormire sinant.' The American ethnologist, Morton, in his 'Crania Americana,' p. 115, 1839, refers to the production of the parieto-occipital

some posthumous pressure. Owing to this distortion the line of maximum breadth can only be taken approximatively; we are, however, justified in saying that it lay low down in the skull-walls, and that the parietal tubera were not well marked, though they are so sometimes even in male skulls of this type.

asymmetry, which he observed as often on one side as the other, in the skulls of modern Peruvians, in part at least 'to the manner in which the child is placed in the cradle.' See also Nott and Gliddon, 'Types of Mankind,' p. 325, 1854; 'Indigenous Races,' pp. 334–336, 1857. Dr. Gosse in his 'Essai sur les Déformations artificielles du Crâne,' p. 74, 1855, refers both to Vesalius and to Morton, and speaking of 'l'action prolongée de ce genre de berceau, le compagnon des peuples nomades sur l'aplatissement du derrière de la tête,' he adds, 'Les anciens habitants de la Scandinavie et de la Calédonie devaient s'en servir si l'on en juge par la forme de leurs crânes.' Professor Daniel Wilson of Toronto, who does not seem to have been acquainted at this time (1857) with Dr. Gosse's work, explained the asymmetry of certain ancient British brachycephali similarly. See 'Canadian Journal,' vol. ii. p. 406; 'Edinb. Phil. Journal,' N.S. vii. p. 25, Jan. 1858. In 1862 ('Canadian Journal,' Sept., 'On Ethnical Forms and Artificial Deformations') he suggested that peculiar modes of carrying the infant during suckling, or peculiarities of head-dress, or carriage of burdens on the head might, as well as the use of the cradle-board, produce this undesigned though artificial deformity. In a later paper ('Canadian Journal,' 1864, p. 403) Professor Wilson says that this deformity is usually on the left side. Dr. E. Zuckerkandl ('Reise der Österr. Fregatte Novara,' p. 43 seqq., 1875) has also found parieto-occipital asymmetry to be usually sinistral; and more frequent in brachycephalous and large than in dolichocephalous and small skulls; he explains its occurrence by a reference to pressure inter partum. It appears to me to be more reasonable to explain the greater frequency of sinistral deformation in children by a reference to 'dextral pre-eminence' in the mothers. Savages are at least as distinctively 'right-handed' as civilised races. See Weisbach, 'Reise der Österr. Fregatte Novara,' 1867, Abtheil. ii. p. 181, where the author speaks of 'die stärkere Entwickelung der rechten Seite die wohl bei allen Wilden beobachten war;' and Ogle, 'Med. Chir. Trans.' 1871, vol. liv. of Andamanese, Fuegians, and Eskimos. The wish to keep the right arm free causes the left arm to be usually employed for carrying a child; the pressure of a sling used in aid of the left arm would come to bear mainly on the left side of the child's head, and the observed flattening would thus be accounted for. It is by no means rare, as Professor Wilson has observed, to find instances of unilateral parieto-occipital deformity produced artificially, though unintentionally, in modern times. A modern skull, as it is believed of an Italian, with very well-marked flattening of the right side of the region specified, may be seen in the Oxford University Museum, No. 865 a. A cast of the interior of this skull shows that the flattening has not affected the occipital lobes proper, i.e. the parts of the brain which are lodged in the superior occipital squama and lie behind the internal perpendicular fissure, but has left them overlapping the cerebellum just as in typical dolichocephalic brains. The part of the brain which has been flattened is that which lies between the plane of the apex of the fissure of Sylvius and that of the internal perpendicular fissure. It has often been suggested, and, as regards alterations of nervous structures, not altogether unreasonably, that such artificially produced alterations may in course of time become hereditary. And it may be possible to explain the brachycephalism of most nomad and indeed of some other races by a reference to the mode of carriage in infancy. For Artificial Cranial Deformities purposively produced, see pp. 194 seqq., infra.

FLIXTON WOLD.

[lxxi. 5. p. 275.]



SKULL OF A YOUNG WOMAN OF FROM TWENTY TO TWENTY-FOUR YEARS OF AGE AND 5 FT. 1 IN. IN STATURE.

I. Measurements of Calvaria.

Extreme length	6·8″	Cubical capacity	90·5″
Fronto-inial length	6·7″	Frontal arc	5·2″
Extreme breadth	5·6″	Parietal arc	5·1″
Upright height	5·9″	Occipital arc	4·2″
Absolute height	5·6″	Minimum frontal width	3·8″
Basi-cranial axis	4″	Maximum frontal width	4·8″
Circumference	20″	Maximum occipital width	4·5″

II. Measurements of Face.

Length of face	2·05″
Width of face	4·8″
Basio-subnasal line	3·8″
Basio-alveolar line	4″
Interangular diameter of lower jaw	3·3″
Depth of lower jaw at symphysis	1·3″
Width of ramus of lower jaw on level with grinding surface of molars	1·3″
Height of orbit	1·4″
Width of orbit	1·6″
Length of nose	1·8″
Width of nose	1·95″

III. Indices.

Cephalic (length-breadth) index	82
Antero-posterior index	49
Basilar angle of Broca	26
Facial angle at nasal spine	70
Facial angle at alveolar edge	65

The form, size, and the condition of development of the skeletal taken together with the cranial bones enable us to say that their owner was a woman between twenty and twenty-four years of age. The femur and tibia, which are respectively 16·8″ and 13·4″ in length, have their proximal and distal epiphyses anchylosed, with faint traces of the lines of junction still remaining; the epiphyses are adherent in the cases of the fibulae, but the traces of their lines of junction are very evident, as is also the case with the proximal end of the humerus, which however has its olecranic fossa perforated, and with the distal epiphysis of the radius. The sacrum is not complete, nor the os innominatum, nor the clavicle, but the basi-sphenoid suture is perfectly closed, though the wisdom teeth are not yet quite come into actual use.

This skull contrasts with the first-described in points characteristic of sex, as also in its state of more perfect preservation, in which point indeed it differs from most other skulls in this series, as it does also in its alveolar prognathism. The supraciliary ridges are smaller, the frontal and the parieto-occipital regions more vertical, the height, though considerable, less, and the lower jaw

less powerful than is the case in the male skull of the same age. In the norma verticalis the left half of the skull is seen to be, as is not uncommonly the case, a little fuller and longer than the right; the parietal tubera are placed far back and prominent, but they do not constitute the broadest part of the skull, which, as is usual in well-filled brachycephalic skulls, lies on a level with the upper and posterior angle of the squamous part of the temporal bone and in a plane considerably anterior to that occupied by the parietal tubera. The sides of the occipital pentagon converge somewhat rapidly, a sexual characteristic, from this level of maximum breadth. The slope, on the other hand, from the mesial sagittal line to the parietal tubera on either side is a little more pronounced than is usual in female skulls. The mesial sagittal line maintains its elevation up to the coronal suture, and some little way forward on to the frontal bone. A broad undulation may be observed on either side in the vertical aspect of the skull between the parietal tubera and the coronal suture; it appears however to be due rather to the prominence of the parietal tubera than to any depression such as is often observable in this part of the parietal. Owing to the non-development of an occipital tuberosity, there is a difference of $\frac{1}{10}$th of an inch between the extreme and the fronto-inial lengths, a point often observable in young brachycephalic skulls, but of no real importance as compared with such points as the vertical direction and flatness of the superior occipital squama, the backward position of the parietal tubera, and the abrupt dip downward of the parieto-occipital region immediately posterior to the level of these tubera, and the very considerable relative height, all characteristic of the brachycephalic type, and all recognisable in this skull.

The skull Weaverthorpe (Smith, xlvi) has not admitted of having its cubical capacity taken; a male brachycephalic skull (Goodmanham, No. xcviii, p. 305), however, of strikingly similar contour in its smaller as well as its larger outlines to this, which belonged to an individual about 5″ taller than the owner of the skull here described, exceeds its cubic capacity by only 10 cubic inches. The cubic capacity of the Flixton female skull being 90·5 inches, is somewhat larger than that (1484·23 cub. cent. = 90·276 cub. inches) found by Professor Broca to be the average of ninety Parisian skulls, presumably of both sexes, of the present century, 'qui provenaient

tous des sépultures particulières.' See 'Mémoires d'Anthropologie,' i. pp. 354, 355, 1871; or 'Bull. Soc. Anthr. de Paris,' vol. ii. Sér. i. p. 510.

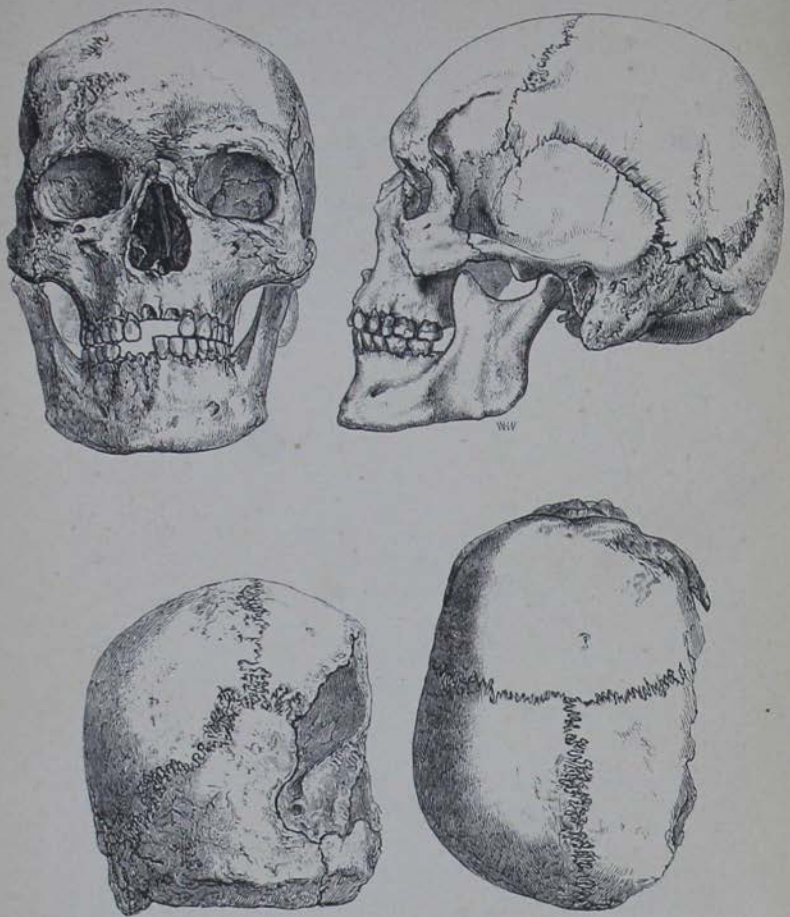
HESLERTON WOLD.

[v. p. 142.]

This skull presents many of the peculiarities distinctive of a male brachycephalic skull of pre-historic times, and in a form which is by no means extinct at the present day. It has lost considerable portions of the left parietal and temporal bones, as also of the left half of the occipital, by water-wear; the rest of the skull however, and the jaws, are in good preservation. The forehead has the obliquity so usually found in the skulls of strong male subjects; the parieto-occipital region, on the other hand, shows the abrupt dip characteristic of the brachycephalic type. The external occipital protuberance is the most backwardly placed portion of the skull; and the extreme length and the fronto-inial length therefore coincide. The absence however of the portions of the skull-walls specified enables us to see that the cerebral hemisphere of the left side has overlapped the cerebellum by a considerable length. The point of maximum transverse width lies at a lower level than and anteriorly to the faintly-marked parietal tubera which are situated far back in the norma verticalis. In this view the skull itself is seen to be little more bluntly oval and more globosely rounded out than the figure given of it. The supraciliary ridges are largely developed, a broad but shallow and transversely sutured furrow representing the glabella between them. The muscular and mastoid ridges are large, the teeth however are small, and the wisdom teeth have not been developed in either jaw. The sagittal and coronal sutures are open in both tables of the skull. This skull represents in an early period of life the same modification of the brachycephalic type which we have represented to us in advanced life by such forms as that of 'Rudstone, lxiii. 9,' figured and described below at pages 190, 192, and in which we find a markedly oblique frontal combined with a parieto-occipital region as markedly vertical. The lesser obliquity of the frontal slope[1] in the skull now before us

[1] See Cleland, 'Phil. Trans.,' 1870, pp. 136, 163, and p. 190, note, infra.

is, like the smaller development of its frontal sinuses, the patency of its sutures, and some other peculiarities, to be explained by a reference to the lesser age of its owner.



SKULL OF A MAN IN THE EARLIER PORTION OF THE MIDDLE PERIOD OF LIFE.

I. Measurements of Calvaria.

Extreme length	7″	Frontal arc	4·6″
Fronto-inial length	7″	Parietal arc	4·7″
Extreme breadth	5·6″	Occipital arc	5·1″
Vertical height	5·6″	Minimum frontal width	4″
Absolute height	5·4″	Maximum frontal width	4·7″
Basi-cranial axis	4″	Maximum occipital width, approximatively	4″
Circumference	20·3″		

II. Measurements of Face.

Length of face: 'nasal-alveolar' line	2·6″
Breadth of face: 'interzygomatic' line	5·2″
'Basio-subnasal' line	3·7″
'Basio-alveolar' line	3·8″
Height of orbit	1·1″
Width of orbit	1·7″
Length of nose	2″
Width of nose	1·1″
Lower jaw, interangular diameter	3·6″
Lower jaw, depth at symphysis	1·45″
Lower jaw, width of ramus	1·3″

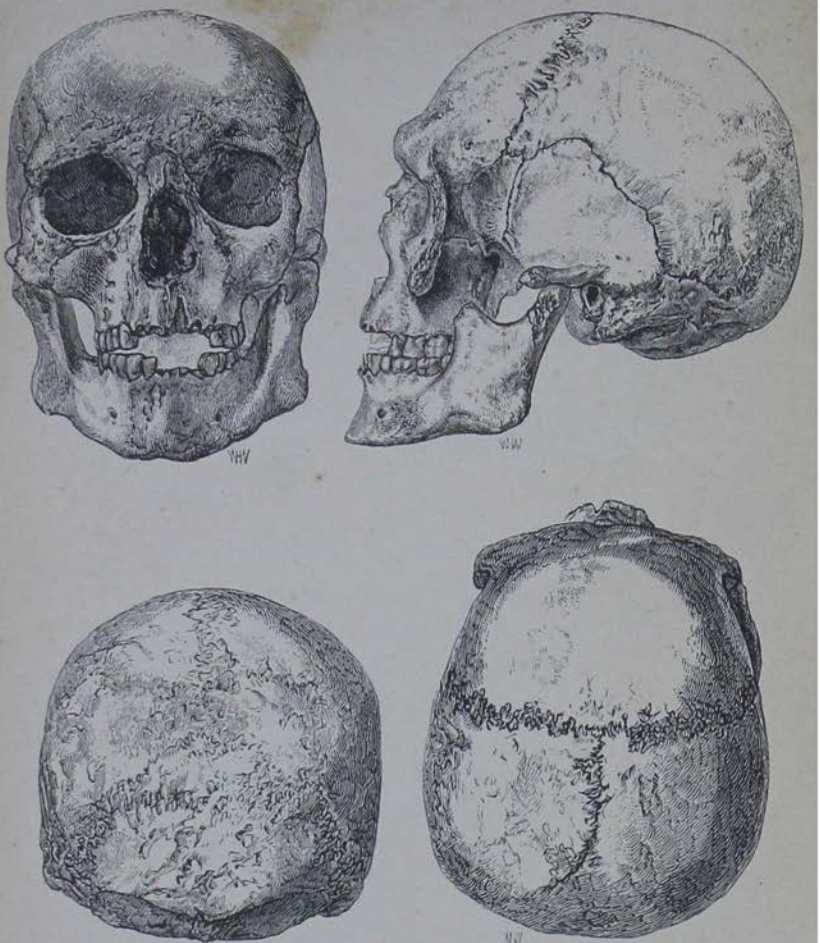
III. Indices.

Length-breadth index: 'cephalic index'	80
Antero-posterior index	54
Basilar angle	25
Facial angle to nasal spine	70
Facial angle to alveolar border	66

ILDERTON, NORTHUMBERLAND.

The femur of the skeleton to which this skull belonged is 19·1″ in length, and has its various ridges, and especially that which is in relation with the insertion of the glutaeus maximus, considerably developed. The humerus is 12·7″ long, and by examination of this bone, of the femur, of the skull, and the lower jaw, we are enabled to say that they belonged to a strong male in the later part of the middle period of life, probably about fifty years of age and 5′ 9″ in height. In the greater obliquity of its forehead and the larger development of its supraciliary ridges this skull differs from the one which precedes it, and forms a connecting link between such skulls as that and the one which is described at pages 190, 194, viz. 'Rudstone, lxiii. 9.' The relations between the basi-cranial axis, the basio-subnasal line, and the basio-alveolar respectively, as well as the verticality of the pterygoids, show that this skull is essentially orthognathous, as His and Rütimeyer in treating of skulls of a similar type, viz. their 'Disentis' type, say ('Crania Helvetica,' p. 27) all pre-historic

skulls of widely-spread races have been. The comparative lowness therefore of the facial angles, 65 and 61, as obtained by M. Broca's goniometer, is to be ascribed to the slope of the forehead, not



SKULL OF A MAN IN LATER PART OF MIDDLE PERIOD OF LIFE AND 5 FT. 9 IN. IN HEIGHT.

to any thrusting forward of the jaws; and the slope of the forehead is to be viewed as correlated with the powerfully developed and

I. Measurements of Calvaria.

Extreme length	7·2″	Cubical capacity	95″
Fronto-inial length	7·2″	Frontal arc	4·9″
Extreme breadth	5·9″	Parietal arc	4·8″
Vertical height	5·9″	Occipital arc	5·2″
Absolute height	5·2″	Minimum frontal width	4·4″
Basi-cranial axis	4·05″	Maximum frontal width	5·5″
Circumference	21″	Maximum occipital width	4·9″

II. Measurements of Face.

Length of face: naso-alveolar line	2·9″
Breadth of face: 'interzygomatic' line	5·6″
'Basio-subnasal' line	3·6″
'Basio-alveolar' line	3·8″
Height of orbit	1·4″
Width of orbit	1·7″
Length of nose	2·1″
Width of nose	0·9″
Lower jaw, interangular diameter	4·9″
Lower jaw, depth at symphysis	1·4″
Lower jaw, width of ramus	1·5″

III. Indices.

Length-breadth index: 'cephalic index'	82
Antero-posterior index	54
Basilar angle	14
Facial angle to nasal spine	65
Facial angle to alveolar edge	61

heavy lower jaw, the downward gravitation[1] of which has been counterbalanced by a backward rotation of the brain and its containing case. The fronto-inial and fronto-postremal diameters are identical, so are the maximum height and the maximum width; the point for the latter measurement lies low down on the parietal bones, on a level with the posterior superior angle of the squamous part of the temporal bone, and in a plane which would touch the anterior edge of the faintly marked tubera parietalia. There is a considerable downgrowth of the occipital condyles, as is often observed to be the case in skulls with heavy lower jaws, especially in the later half of life; the skull however is supported by the conceptacula cerebelli and the grinding edge of the molar teeth when it is placed upon a flat surface without its lower jaw. The extent of its cranial curvature is spoken to by this last fact, as also by the lowness of its basilar angle, 14, as obtained by the occipital goniometer of Prof. Broca. In the occipital and vertical normae this skull shows the rounded outlines characteristic of well-filled skulls. In the latter of these normae it shows the characteristic proportions,

[1] See Cleland, 'Phil. Trans.' 1870, pp. 136 163.

and in the norma lateralis the characteristic contour of the brachycephalic skull. The lower jaw, with its great width, flanged-out angles, and prominent bifid mentum, shows that its owner was a man of considerable strength. The teeth are comparatively small, and not as much worn as the teeth are usually in skulls of individuals of this period and the age of this subject. The cranial sutures, especially the sagittal, have undergone extensive obliteration.

This skull has been figured and described by the Rev. W. Greenwell, M.A., and D. Embleton, M.D., in the Natural History Transactions of Northumberland and Durham, Tyneside Field Club, vol. i. pl. xiii.

COWLAM.

[lix. 3. p. 226.]

A fragmentary femur gives a probable length of 18·5″ for the perfect bone, from which we may calculate the stature as having been 5′ 7″, about an inch and a half less than the average stature assigned to the brachycephalous British by Dr. Thurnam upon an examination of twenty-seven femora. The femur in question shows its owner to have been a man of considerable strength and to have been in the later period of middle life, conclusions to which the condition and character of the skull would likewise point. The articular surface of the head of the femur has encroached a little way on to its neck anteriorly, which may indicate the existence in early life of some disease of the joint which was recovered from.

The sagittal and coronal sutures are still patent, both internally and externally, for a considerable part of their extent. The skull itself is a most favourable specimen of the brachycephalic type, combining as it does indications of strength with great size, and yet showing no marks of savagery. It assuredly merits the titles of 'Kräftigkeit und Würde,' which His and Rütimeyer ('Jahrbuch der Schweizer Alpen,' for 1864, p. 398) bestow upon the better developed skulls of their 'Sion Typus;' though it belongs to the class of skull assigned by those anthropologists to their 'Disentis Typus.' The skull as a whole is sub-quadrate or sub-cubical in outline, but being filled out in each individual region it gains an appearance of general smoothness and globosity. The supraciliary ridges are less in size and the forehead is less oblique than is at all usual in skulls

of this period which belonged to owners of such strength as the powerful and well-defined lower jaw speaks to. The point of maximum height when the skull is in its normal position lies a little way behind the coronal suture; and by the greatness of this height, both absolute and relative, and by its situation at this point, one of the most characteristic features of this type of skull is constituted. In this the ancient British brachycephali resemble the neolithic Danes, as pointed out by Professor Busk [1].

The occipital squama occupies a plane a little posterior to that occupied by the posterior half of the parietals, as is the case in some of the brachycephalic skulls just referred to and others: the occipital protuberance having been lost, together with a large part of the occipital bone, it is not now possible to say with safety whether the fronto-inial line was or was not shorter than the fronto-postremal. The cerebral overlap however has certainly been considerable, and the conceptacula cerebelli are more horizontal than is usual in skulls of this type. This however may be partly due to the commencement of senile gravitation [2] changes. The posterior part of the parietals shows the normal brachycephalic perpendicularity, the small foramina emissaria, not seen in the drawing, being entirely on the posterior aspect of the skull. In spite of the very considerable frontal width the zygomatic arch still comes into view in the norma verticalis, and this width, together with that of the interangular diameter of the lower jaw, must have given the face a marked expression of strength during life. The sockets of the canine give a square outline to the front of the upper jaw. The norma occipitalis, like the norma verticalis, is remarkable for the rounding off of its outstanding angles. Skulls strikingly similar to this, both in contour and measurements, are to be found in modern European races, e.g. in the Grisons [3] amongst the Roumansch-speaking populations, for a specimen of which see skull 768 in Oxford University Museum, obtained from the neighbourhood of Andeer by Dyce Duckworth, Esq., M.D., or amongst the Finns [4], for a specimen of which see a skull 'e Diocesi

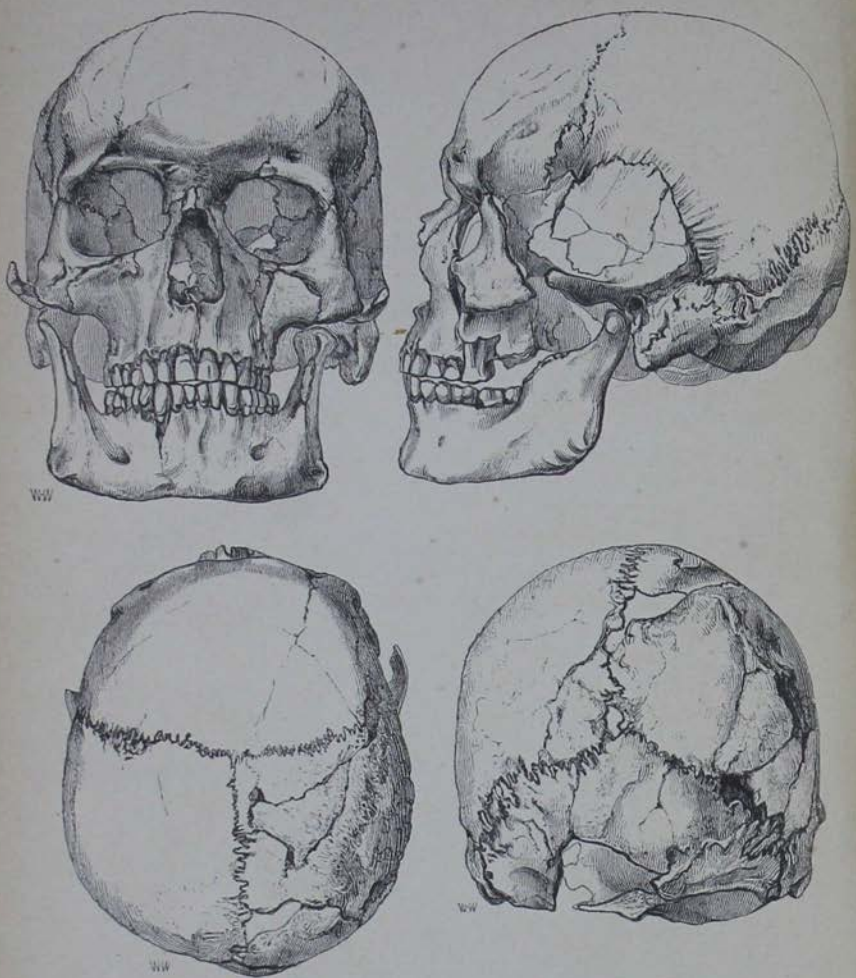
[1] See 'Journal of the Ethnological Society,' p. 468, Jan. 1871.

[2] See Cleland, 'Phil. Trans.,' 1870, pp. 136, 137.

[3] For a memoir on the population of the Grisons, see V. Baer, 'Bull. Acad. Imp. des Sciences St. Pétersbourg,' p. 38 seqq., 1860.

[4] For the Ethnology of the Finns, see Virchow, 'Archiv für Anthropologie,' vol. iv. p. 78; 'Zeitschrift für Ethnologie,' vol. v. p. 320.

Saarijärvi' presented to the University Museum by Professor E. Eichwald.



SKULL OF A MAN IN LATER MIDDLE LIFE AND 5 FT. 7 IN. IN HEIGHT.

Still closer is the resemblance to this prehistoric British type borne by the prehistoric Danish brachycephalic crania in which the

I. Measurements of Calvaria.

Extreme length	7·5″	Parietal arc	5·6″
Extreme breadth	6·3″	Occipital arc	5·1″
Vertical height	6·5″	Maximum frontal width	5·3″
Absolute height	6·4″	Minimum frontal width	4·1″
Circumference	22·1″	Maximum occipital width, approximatively	5·1″
Frontal arc	5·4″		

II. Measurements of Face.

Length of face: 'naso-alveolar line'	2·9″
Breadth of face: 'interzygomatic line,' approximatively	5·65″
Height of orbit	1·45″
Width of orbit	1·7″
Length of nose	1·9″
Width of nose	0·9″
Lower jaw, interangular diameter	4·1″
Lower jaw, depth at symphysis	1·5″
Lower jaw, width of ramus on level of grinding surface of molar teeth	1 5″

III. Indices.

Length-breadth index: 'cephalic index'	84
Antero-posterior index	50
Facial angle to nasal spine	72
Facial angle to alveolar edge	69

height is, contrary to what we see in modern European skulls of the same type, greater than the breadth. A comparison indeed of such a series as that which has been obtained from the small Danish island of Moen, figures and casts of some of the crania of which are readily accessible[1], with such a series of skulls as that which Canon Greenwell has presented to the Oxford Museum from the British round barrows, is instructive in many ways. By going over the entire number of specimens contained in such series we learn, firstly, that forms so widely different at first sight as the skull 'Cowlam, lix. 3,' and the one next to be described, or the one from Borreby figured in Sir Charles Lyell's 'Antiquity of Man' (p. 91, 4th ed. 1871), are nevertheless found in company and contemporaneity with each other in many barrows. Secondly, we find that

[1] For figures of crania from the tumuli in Moen, see Nilsson's 'Stone Age' (trans. Lubbock), 1868, pl. xii. figs. 230–232, pl. xiii. fig. 240, pp. 121, 126; Sir John Lubbock's 'Prehistoric Times' (3rd ed.), p. 159; Retzius' 'Ethnographische Schriften,' pl. iii. fig. 2. A cast, No. 5710, of a small skull from Moen is to be seen in the Royal College of Surgeons in London, and another of a larger one from Udby in the same island was procured from the late Professor Thomsen through the kind offices of Dr. F. Krebs for the Oxford University Museum. The original of this cast has been measured and described by Professor Virchow in the 'Archiv für Anthropologie,' tom. iv. pp. 68, 84, where he draws especial attention to its 'capsuläres Hinterhaupt mit starken Schaltknochen der Lambdanaht,' points observable in 'Cowlam, lix. 3.'

in many cases they are connected by transitional forms. Thirdly, in series containing either well-developed and capacious skulls, such as 'Cowlam, lix. 3,' or rough-hewn crania such as 'Rudstone, lxiii. 9,' the one next to be described, or both, we find in England[1] as well as in Denmark skulls differing from them in being at once themselves 'ill-filled,' and in being indicative of feebleness in their owners. The existence of such skulls in such series in Denmark has often been explained by supposing them to have belonged to a Lapp population. This explanation however will not account for their presence in the Bronze-Period barrows of this country.

RUDSTONE.

[lxiii. 9. p. 248.]

With the cranium, 'Rudstone, lxiii. 9,' there came into my hands two femora, the length (19·1″) and strength of which, as also the character of the skull, show that we have here to deal with the remains of a man of great muscular strength, of about 5′ 9″ in stature, and 'past the middle period of life,' if not indeed 'aged.'

The skull itself is a good example of one form of the brachycephalic cranium, which is distinguished by having a very oblique and low-lying frontal region, and large supraciliary ridges, which, if covered with large eyebrows during life, would have given a somewhat beetling and forbidding expression to the countenance. In the skull now before us the obliquity of the forehead is probably somewhat increased by the commencing[2] of the senile settling

[1] The series from Cowlam, Rudstone, Weaverthorpe, Goodmanham, and some others furnish specimens of small delicate skulls in company with one or other of the larger and stronger varieties of the brachycephalic type.

[2] There can be no doubt that with the atrophy of the brain which sometimes accompanies other senile changes some substance must, in the nature of things, be developed to fill up the void thus caused. In some cases an effusion of subarachnoid fluid occupies the space as fast as it is formed, and in a case of a very aged man, Dr. Holyoke of Salem, Massachusetts, a person known to be a centenarian, whose body was examined after death, and whose symptoms of intra-cranial fluctuation during life were recorded by himself (see 'Memoirs,' p. 48 seqq., Boston, U. S. A., 1829), this fluid must have been exuded in great abundance to occupy the space rendered available by the shrinking of the brain.

In other cases, as also to a considerable extent even when fluid is poured out in the subarachnoid space, the inner table of the skull appears to secrete fresh laminae of bone,

down of that region as it follows after the retreating brain, but the brachycephalic form with retreating and low forehead is recognisable in quite young skulls both of early, as in the case of the 'Heslerton Wold Hall Grave' skull already described, and of present times.

Other senile changes are beginning to show themselves in this skull in the way of loss of compactness of tissue and consequently of gloss and smoothness on the external surface, in the very extensive obliteration of sutures even in the external table of the skull, a condition less frequently observed in brachycephalic than in dolichocephalic skulls, and in the wearing down of the teeth to an extent which, in an ill-nourished[1] individual, would have produced alveolar abscesses. The conceptacula cerebelli are larger relatively to the space occupied by the superior squama occipitis in this than in most skulls, and the occipital protuberance is very considerably developed and devoid of any traces of division into lineae superiores and lineae supremae, as, Von Baer[2] observes, is usually the case when

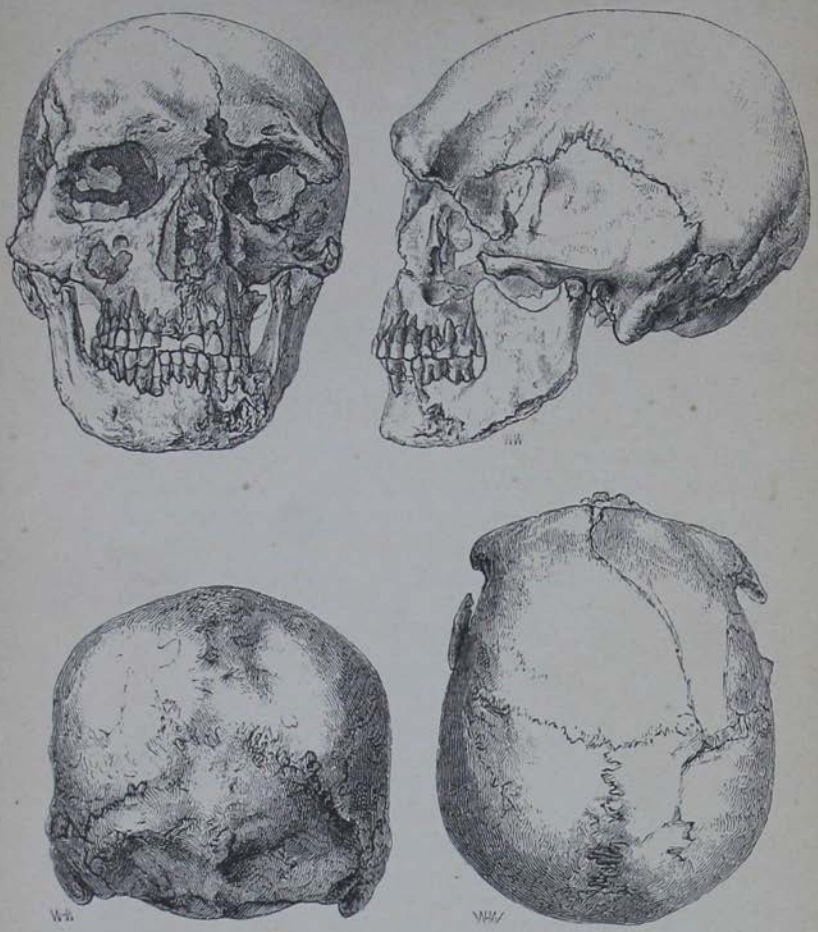
and is found closely adherent, as in infancy, to the dura mater. In such cases the grooves for the meningeal arteries appear to be deeply sunken into the substance of the skull, having been in reality converted into deeper channels, or even tubes, by the upgrowth of bone around them. This was the case in the body of a man supposed to be 106 years old examined by me, as recorded in the 'British and Foreign Medico-Chirurgical Review,' p. 508, April 1863 (Article XII, p. 141 of this volume). A skull of a very aged person may under such circumstances attain a thickness of as much as 15 millimetres, forming thereby a striking contrast to equally senile skulls in which the cranial walls may have been reduced to paper-thinness or actual fenestration by atrophy.

In a third class of cases the retreating brain is followed up by the skull-walls; and especially in the frontal region is this concomitance of involution observable, both in the living subject and in the skull, as has been noted by Lavater and Froriep, cited by Cleland, 'Phil. Trans.' p. 136, 1870. In some of these cases the inner table of the skull will thicken simultaneously with the gradual sinking down of the cranial vault. In a skull of an aged man, probably a Roman officer, eminently dolichocephalic, forwarded to me by the Rev. W. Lukis, F.S.A., from Wath, near Ripon, I find, coincidently with an extraordinary obliquity of the os frontis, two raised areae, covering a space of a little more than an inch square on each side, as though they were growing down into the space vacated by the atrophying frontal convolutions. Some of the appearances which have been dwelt upon as characteristic of 'Neanderthaloid' crania are, I am well assured, to be ascribed to these purely physiological, though senile, changes of form, and have absolutely no ethnological significance whatever, except in so far as the texture of brachycephalic crania is usually stouter and more resistent to gravitation changes than is that of the dolichocephalic, amongst which most of the skulls just mentioned are to be classed.

[1] See J. Mummery, On the Relations of Dental Caries in Aboriginal Races. 'Trans. Odont. Soc.' Nov. 1869.

[2] 'Crania Selecta,' Mém. Acad. Imp. Sci. St. Pétersbourg, Ser. vi. tom. viii. 185. His words are, 'Cristam (transversam occipitis) in plurimis hominibus in binos arcus

the inferior preponderates in size over the superior squama occipitis.



SKULL OF A MAN PAST MIDDLE PERIOD OF LIFE; OF 5 FT. 9 IN. IN STATURE.

In the norma basalis we have to note the width of the basilar

sub angulo manifesto inter se conjunctos dividi patet; attamen in animalibus multis crista transversa occipitis etiam binis arcubus constituitur, et in homine angulus medius non raro fere evanescit, et quidem ubi pars inferior ossis occipitis magnam habet evolutionem, pars superior vero parvam.'

I. Measurements of Calvaria.

Extreme length	7·2″	Cubical capacity	90″
Fronto-inial length	7·2″	Frontal arc	5·1″
Extreme breadth	5·8″	Parietal arc	4·7″
Vertical height	5·7″	Occipital arc	4·5″
Absolute height	5·2″	Minimum frontal width	4″
Basi-cranial axis	3·9″	Maximum frontal width	4·9″
Circumference	22″	Maximum occipital width	4·4″

II. Measurements of Face.

Length of face: 'naso-alveolar' line	2·7″
'Basio-subnasal' line	3·7″
'Basio-alveolar' line	3·9″
Height of orbit	1·3″
Width of orbit	1·8″
Length of nose	2·1″
Width of nose	1″
Lower jaw, interangular diameter	4·1″
Lower jaw, depth at symphysis	1·1″
Lower jaw, width of ramus	1·7″

III. Indices.

Length-breadth index: 'cephalic index'	81
Antero-posterior index	55
Basilar angle	19
Facial angle to base of nasal spine	65
Facial angle to alveolar border of upper jaw	60

process of the occipital bone, a point often remarkable in the lower races of mankind, and the roughness and thickening of the posterior border of the occipital foramen, a development often noticeable in skulls with the brain-case rotated backwards, and correlated with the maintenance of the balance of the head by giving attachment to ligaments.

The wisdom teeth are very much less worn than the two first molars; only one wisdom tooth however has been developed in the lower law.

The lower jaw has lost by water-wear a good deal of its angle on the side figured; the angle on the side not shown in the figure, though it would even by itself have been assigned to the male sex, has by no means the boldly defined outlines and large size usually seen in the brachycephali of this series. The inter-angular diameter however of the entire jaw is as large as that of even larger skulls of this type.

The parieto-occipital dip is eminently brachycephalic; the point of maximum height is anterior to the coronal suture, the point of maximum width is the region representing the faintly marked parietal tubera.

This skull does not show any traces of the not uncommon asymmetry of the parieto-occipital region produced by careless one-sided carriage in infancy; but it has a singular and suggestive resemblance to many of the artificially deformed skulls of the New World, though it is not likely that it was subjected to any such process purposively carried out. Skulls like this resemble some of the purposively deformed skulls, firstly, in general antero-posterior contour from the large supraciliary ridges over to the similarly developed transversa crista occipitis; secondly, in the general relations of maximum breadth to the extreme length; thirdly, in the position of that plane of maximum breadth far back in the plane of extreme length; fourthly, in the width and strength of the upper and lower jaws; and, fifthly, in the minor yet not wholly unimportant point of the disparity of size between the upper and lower squamae occipitis with their respective nervous contents. Nor is prognathism, which is almost always absent in these priscan skulls, by any means always present in the artificially deformed ones of modern times. Skulls like the one just described have a calculable brain weight of 54 oz. avoidupois, which is considerably above the average weight 49·5 oz. for European males in modern times; their powerful lower jaw and the bones of their limbs show them to have been possessed of muscular strength at least as much superior to that of average men; and their owners, for these as well as for other reasons which it is not my purpose to discuss here[1], may be very reasonably supposed to have been chiefs of their clan or tribe. The physical peculiarities however of individuals in such positions are very usually imitated by other members of their clan, tribe, or nation; and it may be suggested that the habit of artificially deforming the head, at all events as we see it most commonly done when it results in the production of a form like the one just described, may have arisen from the wish to give a child from the first the outlines which distinguished some adult whose vigour had placed him in a position of eminence and command[2].

[1] See Address to Anthropological Subsection, 'British Assoc. Report for 1875,' p. 150.

[2] It is not entirely easy even with a large number, as in the Oxford Museum, of artificially deformed skulls to be perfectly certain that such a skull as the one above described cannot have owed its peculiar contour to compression purposively exercised upon it during the period of infancy. Some sort of *a priori* probability in favour of this skull having been endowed with its peculiar shape by this means arises of course

Professor Busk has, loc. infra cit., felicitously suggested the restoration of the Linnaean term 'plagiocephalic' to this strongly

from its very close resemblance to the Oregon, Peruvian, and other antero-posteriorly compressed skulls which we know as a matter of fact to have been so treated, and which we see to be as free, if they be skulls of aged individuals, from any traces of the severe treatment they underwent in the first two years of life, as in the skull now before us. It is obvious, whatever may be said to the contrary, that a deformation which goes so far as materially to alter the relative proportions of the several lobes of the brain to each other without materially altering the anatomical relation of those lobes to the skull bones covering them, which M. Broca has ('Bulletin de la Société d'Anthropologie,' 1870, p. 115) shown that the 'Déformation Toulonnaise' actually does, must be put in play in these early days. For of the 22 inches or so (= 555 mm.) which may be taken (Bischoff, 'Sitzungsberichte k. bayer. Akad. Wiss. München,' 1864, Bd. i. p. 39) as the average head circumference of a living male adult, no less, but a little more, than nineteen inches and a half (= 500 mm. = 19·685″) have been shown by Liharzig ('Gesetz des Wachsthums,' 1862, p. 17, Taf. 5) to be attained by the male child of twenty-one months old. And between twenty-one months and the age to which the owner of such a skull as this must have attained, abundant time would have been afforded for smoothing down, rounding off, and removing any such traces of the action of any deforming apparatus as are sometimes to be seen in younger skulls (*e.g.* in a skull from Vancouver's Island, No. 826 a. Oxford Museum) which have been subjected to it. Further, the fact that in a country so near as France a practice of depressing the head has lasted in Normandy (Retzius, 'Ethnograph. Schriften,' p. 130) and in the non-Iberian parts of Southern France (Foville, cit. Retzius, l.c.) even into our own days,—and in the Tolosan portion of this latter district has been supposed (see Broca, l. c.) to have been a survival of the practice of the Tectosages,—may make us hesitate before definitely refusing, as so many other writers from the times of Haller (cit. Blumenbach, 'De Gen. Hum. Var. Nat.,' l.c.) down to that of Virchow (see 'Congrès Internat. d'Anthropologie,' 1876, tom. i. p. 318) have refused, to accept artificial deformation as the explanation of the conformation of a particular skull, whether it be plagiocephalic as this skull, or annularly constricted like the well-known Avar skulls of Grafenegg and Atzgersdorff. It must however be said, on the other hand, that both these forms of skull, though now well known to be producible artificially, do yet arise spontaneously even in our own day; and it is here suggested that unless a considerable number of skulls of one or other or both of these forms are found together it is unsafe to assert, in the absence of still persistent marks of the action of a compressing or constricting apparatus, that any single skull has been artificially deformed. For in most cases in which we have undoubted evidence of the existence of this practice, skulls of both forms, the plagiocephalic, in which the skull has been compressed from before backwards, and the annularly constricted and elongated form illustrated by the Avar skulls above-mentioned and described by many of the authors enumerated below, have been found together: and in spite of the tendency shown by many writers to make multitudinous divisions of artificial cranial deformities, it is plain from a consideration of the history of the rapid growth of the brain and of the restlessness of children in early life, that it must be exceedingly difficult to prevent, with whatever care and whatever apparatus, the plagiocephalic form from lapsing into the annularly constricted form. A comparison of the account given by M. Dumoutier of the practice ('Bull. Soc. Ethnograph. de Paris,' vol. i. 1847, cit. Gosse, l.c. p. 154) as carried on in Patagonia with the description given by Professor Huxley of a skull brought from Gregory Bay,

marked variety of a strongly brachycephalic type. Skulls of similar proportions and contour have been procured from three or four other round barrows in the East Riding, viz. from barrows in the Goodmanham, Flixton, and Marr series; and two others, also of the same conformation, 'Rudstone, lxiii. 6,' and 'Rudstone, lxviii. 7,' have been procured from this very series. The latter of these two skulls, which belonged to a man past the middle period of life and of about 5 ft. 8 in. in stature, goes farther than most even of the roughest hewn skulls of the Bronze Period to justify the comparison which Dr. Thurnam[1] instituted between them and the macrognathous Maori crania. This skull having been much broken, most of its measurements, as reconstructed, have to be taken with qualification; its great weight, however, 2 lb. 4·9 oz. av., the lower jaw included, but much loss of other bone having been incurred, as against a weight for the much more nearly perfect skull and lower jaw, here figured, of 1 lb. 10 oz. 10 grs. av., is unambiguously indicative as to its great size. Skulls differing from these mainly in the comparatively unimportant particular of a lesser frontal obliquity will be found figured in the 'Crania Helvetica' of His and Rütimeyer, t. ii. p. 130, and in Von Baer's description of the crania and people of the Graubündten[2]. Even more closely similar are the figures of the Borreby skull and of the Ledbury skull given by Professor Huxley in Sir Charles Lyell's 'Antiquity of Man,' p. 91, 4th. ed. 1873, and in 'Prehistoric Remains of Caithness,' 1866, p. 114. In none of these cases however, with the single exception of the Borreby skull, have we

Patagonia, by Dr. Cunningham of H.M.S. 'Nassau,' or of that given by Ellis, l. c. infra, of the Tahiti method with that given by Camper, l. c., of a calvarium brought to Oxford by Captain King (No. 827. University Museum), will show that both forms of artificial deformity existed side by side with each other in Patagonia and in Tahiti. Annularly constricted and elongated skulls, such as the one spoken of by Camper as 'tout pareillement conformée' to the one from Tahiti, have been constantly found in the region of the Nootka Sound in company with the plagiocephalous variety. And the same is notoriously the case with the Peruvian series, though here it must be said that several authors have attempted to show, though not in the writer's opinion successfully, that these two forms of distorted skull may be taken as distinctive either of two different races, or of chiefs as opposed to the common people. See Forbes, l. c. infra, pp. 12, 13. The annularly constricted skulls which have come into the present writer's hands appear to have belonged to females whose treatment, even in matters of this kind, is often, amongst savages, different from that of males.

[1] 'Principal Forms of Ancient British and Gaulish Skulls,' 1865, pp. 31, 102.

[2] 'Bulletin de l'Acad. Imp. des Sciences de Saint Pétersbourg,' vol. i. 1860; or 'Mélanges biologiques tirés du Bulletin,' t. iii.

decisive proof of their having belonged to a Praemetallic Period. No skulls resembling them in their distinctive characters have come into my hands from any British burial-place belonging to the Stone Age. On the other hand, there is no doubt that this variety of the brachycephalic skull has survived and is represented amongst us in modern days. Dr. Beddoe[1], for example, and Professor Virchow[2], have both specially remarked upon the likeness borne by certain modern Danish heads to some of the ancient Borreby crania; and their characteristics are even exaggerated in a presumably modern cranium figured by M. Topinard in his L'Anthropologie, 1876, p. 298, fig. 37.

A few references have been given above, pp. 176, 177 note, to memoirs bearing upon the production of cranial deformities artificially though undesignedly.

The bibliography of artificially and designedly produced deformities is very much more extensive. The following list will be found to comprise the most important notices of and memoirs upon the practice.

Hippocrates, *Περὶ ἀέρων ὑδάτων τόπων*, ed. Littré, tom. ii. pp. 59, 60, 14; ed. Kuhn, tom. i. p. 551; ed. Lind, i. 348, 349; ed. Ermerius, tom. i. 1859, p. 268. *Ἐπιδημίων*, ed. Littré, tom. v. p. 80; ii. 8. Coray's note, p. 224, tom. ii. 1800, in his translation of the former treatise is worth reading.

Strabo, xi. 16, p. 520.

Hiouen-Thsang, fl. A.D. 629–645, cit. Von Baer, loc. infra cit. p. 22; of practice existing at Kashgar, in 'Histoire de la vie de Hiouen-Thsang et de ses voyages,' par Stan. Julien, Paris, 1853, 8vo. p. 396.

J. Bulwer, 'Anthropometamorphosis,' London, 1653, pp. 74–85.

Forster, 'Observations made during a Voyage round the World,' 1778, p. 267, of Mallicollo.

P. Camper, 'Différence des Traits du Visage,' Autrecht, 1791, p. 23 seqq. The works of the late Professor Camper, translated by Dr. Cogan, 1794, also at p. 23.

Blumenbach, 'Decas Craniorum prima,' 1790, iii. p. 17; x. p. 27. 'De generis humani varietate nativa,' 1795, p. 255 seqq., ibique citata—in his own words 'nubem testium.' 'Nova Pentas,' 1822, p. 10, ibique citata.

Ellis, 'Polynesian Researches,' vol. i. pp. 80, 261, 2nd edit. 1831.

Tiedemann and Pentland, 'Zeitschrift für Physiologie,' 1833, Bd. v. p. 108.

'Bulletin Soc. Ethnograph. Paris,' 1847, tom. i. pp. 262–273.

Foville, 'Déformations du Crâne,' 1834. 'Système Nerveux,' i. 632, 1844, pl. 23, figs. 1 and 2.

Williams, 'Missionary Enterprise,' 1837, p. 539.

Morton's 'Crania Americana,' 1839, pp. 117, 203 et passim.

Rathke, 'Müller's Archiv,' 1843. Tschudi, Ibid., 1844, 1845. Retzius, Ibid., 1849, or 'Ethnograph. Schrift.' p. 94.

Morton, cit. Waitz, 'Anthropologie,' iv. 2, p. 386, 'On the Ethnography and Archaeology of the American Aborigines,' New Haven, 1846, p. 18; 'Schoolcraft,' ii. 326.

Meyer, 'Müller's Archiv,' 1850.

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[1] 'Mem. Soc. Anth. London,' vol. iii. p. 383.

[2] 'Archiv für Anthropologie,' vol. iv. p. 71, 1869.

Thierry, A., 'Revue des deux Mondes,' 1852, tom. xxxv. p. 533. Ibid., 1854, p. 241.

Fitzinger, 'Denkschriften,' v. 1854; Akad. Wiss. Wien.

Retzius, 'Müller's Archiv,' 1854, p. 439, and 1858, p. 106; 'Proc. Acad. Nat. Sci. Philadelphia,' vol. vii. p. 405; 'British and Foreign Med. Chir. Rev.' 1860, p. 228. 'Ethnograph. Schrift.' p. 125 e. s.

Morton, in Nott and Gliddon, 'Types of Mankind,' 1854, pp. 436, 440.

Gosse, 'Essai sur les Déformations artificielles du Crâne,' 1855.

Nott and Gliddon, 'Indigenous Races of the Earth,' 1857, p. 335.

Wagner, A., 'Geschichte der Urwelt,' 2nd edit. 1858, p. 39.

Von Baer, 'Mémoires de l'Académie des Sciences de St. Pétersbourg,' Sér. VII. tom. ii. n^ro^ 6, ibique citata, 1860.

Turner, 'Nineteen Years in Polynesia,' 1861, p. 175.

Van der Hoeven and Pruner-Bey, 'Bull. Soc. Anth. Paris,' tom. ii. 1861, p. 449.

Wilson, On Kertch Skulls, 'Edinburgh Phil. Journal,' April, 1861.

Sproat, 'Scenes and Studies of Savage Life,' 1862, pp. 28–30.

C. C. Blake, 'Trans. Ethnolog. Soc. London,' vol. ii. 1862, ibique citata.

Thurnam, 'Crania Britannica,' Decade V. pl. 45, July 1862. Davis, Ibid., chap. ix. p. 233.

His and Rütimeyer and Troyon, 'Crania Helvetica,' 1864, pp. 56–59.

Broca and Lagneau, 'Bulletin Soc. Anth. Paris,' 1864, tom. v. pp. 385–421.

Ecker, A., 'Archiv für Anthropologie,' i. 75, 1866; ix. 1, pp. 61–76, 1876.

Forbes, D., On the Aymara Indians, 'Journ. Ethn. Soc. Lond.' ii. 3, pp. 12, 13, and 205, Oct. 1870. Broca, Ibid., 1871, p. 115; 'Sur la Déformation Toulonnaise.'

Busk and J. B. Davis, 'Journal Anthrop. Instit.' iii. 1, April 1873, p. 86 seqq.

Hutchinson, Consul T. J., 'Journal Anth. Inst.' iii. 3, iv. 1, 1874. Simms, Ibid., iii. 3, p. 327, 1874. Telfer, Commander, Ibid. iv. 1, p. 57, with figure of annectent form.

Wood, 'Cruise in the South Seas,' 1875, p. 41, of Futuna Islanders, Horne Islands, citing Marsden as to Sumatrans, and Captain Cook (see 'Voyage towards the South Pole,' i. p. 366, 1777) as to natives of Ulietea, who however are only represented as flattening the nose, a particular omitted by Forster, 'Observations,' p. 472, in his account of the same proceedings.

Zuckerkandl, 'Reise der Novara,' Anthrop. Theil, 1875, p. 46.

Bancroft, 'Native Races of Pacific States,' vol. i. pp. 158, 228 (where occasional failures are spoken of); vol. ii. 1875, pp. 731, 732; iv. p. 740.

Dupont and Virchow, 'Congrès international d'Anthropologie et d'Archéologie prehistoriques;' 'Compte Rendu,' Stockholm, 1876, pp. 316 and 318.

Wilson, 'Prehistoric Man,' 3rd edit. 1876, chap. xx. ibique citata, esp. Blake, p. 156, for finding of short and long forms together.

Topinard, 'Anthropologie,' 1876, p. 194.

Busk, 'Journal Anth. Inst.,' January 1877, p. 202, on skulls from Mallicollo.

[Flower, 'Monumental Heads and artificially deformed Crania from Mallicollo,' 'Journ. Anthrop. Inst.' vol. xi.]

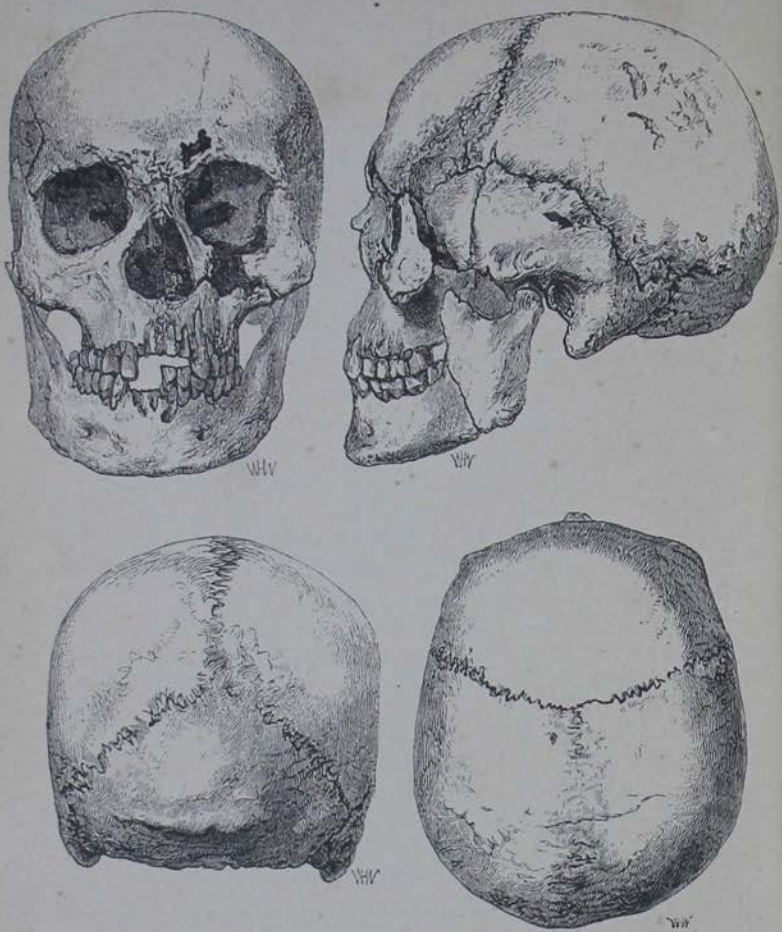
CASTLE CARROCK, CUMBERLAND.

[clxiii. p. 379.]

With the skull 'Castle Carrock, Cumberland,' no bones of the trunk or limbs have come into my hands; there is considerable reason however, from the consideration of the skull alone, for saying

that this skull belonged to a man much 'past the middle period of life,' if not to an 'aged' man. The still outstanding muscular and other processes in the lower part of the skull and the still powerful lower jaw show that the owner of this skull was a person of considerable strength; whilst the general rounding off of the angular portion of the vault of the skull seems referable to the working of senile absorption. The diploic sinuses are exposed on either side in the region of the parietal eminences, as is the case in advanced senile atrophy; the cavities exposed are undoubtedly larger than they would, in almost any circumstances, be until some time after the prime of life; the skull however has suffered somewhat from water-wear, and it is not easy to be sure that some of the excavation and exposure shown in the drawing on the left parietal bone may not be due to this posthumously working cause. The down-growth of the occipital condyles, and of the mastoids, and the spiny roughnesses developed generally at the base of the skull, and specially around the posterior border of its foramen magnum, are points indicative of its advance in age. A somewhat similar skull, from Tosson in Northumberland, presented to the University Museum by Canon Greenwell, has been described by Dr. Barnard Davis in the 'Crania Britannica,' vii. Pl. 54; its sex however does not seem to be quite so certainly male as that of the skull from Castle Carrock, and its age to be a little greater, as is also its cubical capacity, 97·5 as against 95 cubic inches. The two skulls are specially useful as showing the modifications, especially in the way of rounding-off of outlines, which the advance of old age produces upon the more capacious brachycephalic skulls, which when young might have been spoken of as 'têtes carrées,' 'subcubical,' or 'subquadrate.' Both of them have retained comparatively vertical foreheads and the characteristic dip of a slightly asymmetrical parieto-occipital region, the Castle Carrock skull in company with a powerful lower jaw, and the Tosson skull in company with a feebler one; both have their points of maximum transverse width low down upon the parietal bone, both have vertical pterygoids; but the lateral bulging produced by senile change has advanced further in the Tosson specimen, and the plane of maximum width has advanced further forwards relatively to the long axis of the skull. Some of the peculiarities to be seen in the norma basalis and lower jaw of the Castle Carrock skull are very

exactly reproduced in the Tosson specimen, even to such points as the non-development of some of the wisdom teeth and the small size of the entire dental series. The lower jaw of the Tosson skull is feebler



SKULL OF A MAN ADVANCED IN YEARS.

than that of the Cumberland skull, and its coronoid fails, as is more usually the case in dolichocephalic than in brachycephalic skulls, to reach the level of the zygomatic arch, points which, taken

I. Measurements of Calvaria.

Extreme length	7″	Cubical capacity	95″
Fronto-inial length	7″	Frontal arc	5·3″
Extreme breadth	5·6″	Parietal arc	4·9″
Vertical height	5·7″	Occipital arc	4·4″
Absolute height	5·4″	Minimum frontal width	3·95″
Basi-cranial axis	4·05″	Maximum frontal width	5·1″
Circumference	20·7″	Maximum occipital width	4·7″

II. Measurements of Face.

Length of face: 'naso-alveolar' line	2·8″
Breadth of face: 'interzygomatic' line	5·2″
'Basio-subnasal' line	3·7″
'Basio-alveolar' line	3·9″
Height of orbit	1·5″
Width of orbit	1·7″
Length of nose	2·05″
Width of nose	1·2″
Lower jaw, interangular diameter	4·4″
Lower jaw, depth at symphysis	1·3″
Lower jaw, width of ramus	1·3″

III. Indices.

Length-breadth index: 'cephalic index'	80
Antero-posterior index	52
Basilar angle	24
Facial angle to nasal spine	71
Facial angle to alveolar border	66

together with the remarkably small size of its mastoids and its lesser absolute and relative height, may seem to indicate that it is a female skull. However this may be, there can be no doubt that they both are what Dr. Barnard Davis has said one of them, viz. the Tosson skull, is, 'of the typical series of ancient British crania,' and of the typical series, I should add, of the Round Barrow or Bronze Period. As an individual peculiarity in the Castle Carrock skull not observed among the other brachycephalic skulls here figured, may be noted[1] the fact that when placed without its lower jaw, but with the grinding surface of its upper molar teeth upon a horizontal surface, it touches that surface posteriorly, not with its conceptacula cerebelli, but with its occipital condyles. This is mainly due to the downgrowth of these processes, but also in part to the upward slant of the cerebellar fossae, a point more common in brachycephalic than in other crania, and not indicative of deficient cranial curvature when coupled, as in this case, with a vertical forehead.

This skull and the five here described before it are all alike

[1] See Ecker, 'Archiv für Anthropologie,' iv. p. 301, cit. p. 172 supra.

brachycephalic by contour as well as by mere measurement. In all of them, with the exception of 'Rudstone, lxiii. 9,' the 'vertical height' is greater than or at least equal to the 'extreme breadth;' in all of them the posterior part of the parietal bones curves downwards more or less vertically, making thus the distance between the plane of the parietal tubera and that of the back of the head shorter than it is in dolichocephalic skulls and throwing the foramina emissaria entirely on to the back aspect of the cranium. In none of them, whether young or old, is either the coronal or the lambdoid suture entirely obliterated, showing that the form of the skull in them, as we shall hereafter see it is also in the dolichocephalic variety, is dependent upon that of the brain and not upon any synostosis.

With this skull, undoubtedly the oldest of those as yet described, the series of brachycephalic skulls here figured ends; in the arrangement of the dolichocephalic series, next to be entered upon, similar regard has been had to age; and the first skull of that series, 'Langton Wold, ii. 1,' differs from the skull 'Castle Carrock' in the matter of age as much as in any other of its distinctive peculiarities.

LANGTON WOLD.

[ii. 1. p. 136.]

The femora and pelvic bones taken together with the cranium show that the skeleton, Langton Wold i, belonged to a strong man in the early part of middle life, that is to say probably between 30 and 35, of very considerable muscular strength, and about 5 ft. 9 in. in stature. The sacrum and ossa innominata have their sutures and epiphyses completely anchylosed. The two posterior molars however on each side of the jaws are comparatively worn. The femur is of great strength, flanged out in the region of the upper insertion of the glutaeus maximus so as to give this part of the bone a flattened appearance; the inner division of the upper bifurcation of the linea aspera is prolonged into a spiral ridge continuous with the anterior intertrochanteric line, a peculiarity much more marked in the much smaller femora of the skeleton next to be described; whilst the size of the linea aspersa in the area over which its two lips are combined is such as to give the fluted appearance to the posterior aspect of the femur which has procured

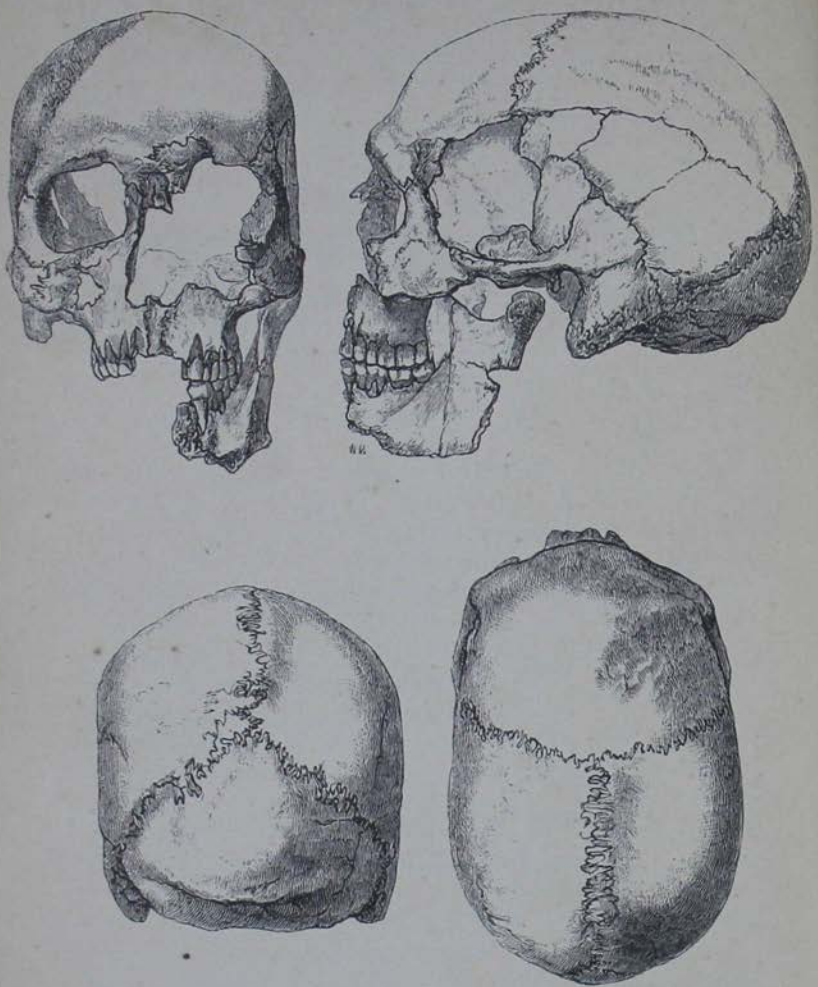
for such bones the name of 'fémurs à colonnes' (Topinard, 'L'Anthropologie,' p. 324, 1876).

This skull, and the one next to be described, Duggleby i. 2, may be taken as typical representatives of the male and female form respectively of the Hohberg type of His and Rütimeyer as described and figured in the 'Crania Helvetica' of those authors. There can be no doubt as to the respective sexes and ages of these two skulls, the trunk and limb-bones of both having been available for examination as well as the crania, though many of both sets of bone in both cases have suffered considerably from posthumous injury, and have to be spoken of as reconstructed.

There are several modifications of the dolichocephalic type found in barrows of the Neolithic Period which do not correspond with the Hohberg type just mentioned; that type however is found in those barrows, and these skulls, though of a later date, very fairly represent it, and their respective sexes being certainly fixed they enable us to distinguish in this type the characters which have an ethnographical from those which have merely a sexual significance.

The skull, Langton Wold i, is distinctly and essentially orthognathous, as shown by comparison of the basi-cranial with the basio-subnasal and basio-alveolar lengths; the supraciliary ridges owe their large size to the masculine character of the skeleton they belong to, they meet, however, as these ridges are said to do in this type by the ethnologists just referred to, without that depression in the middle glabellar line which is usual in the brachycephali; the median vertical contour describes the characteristically equable dolichocephalic curve from the point where the glabella sinks into the oblique facies frontalis of the os frontis to the centre of the superior squama occipitis, where a spot $\frac{2}{10}''$ anterior to the upper side of the external occipital protuberance, and $\frac{3}{10}''$ anterior to the commencement of a linea nuchae mediana, separated by a slight interval from that largely developed ridge, marks the back of the skull. This occipital dolichocephaly, plain enough also on simple inspection, is further made manifest by its low antero-posterior index, 45, though it is right to say that the skull has probably undergone some compression with the usual result of producing a lengthening, and in this case owing to its intrinsic wall-sidedness in the temporal and parietal regions, especially in the posterior half of the skull. The

parietal and occipital arcs each exceed their normal length by $\frac{4}{10}$ths of an inch. The lower jaw being imperfect it is not easy to form an accurate estimate of the amount of compression which may have



SKULL OF A MAN OF FROM THIRTY TO THIRTY-FIVE YEARS OF AGE, AND 5 FT. 9 IN. IN STATURE.

I. Measurements of Calvaria.

Extreme length	7·8″	suture, approximatively	4·4″
Fronto-inial length	7·6″	Circumference	21·2″
Extreme breadth	5·25″	Frontal arc	5″
Vertical height	5·8″	Parietal arc	5·2″
Absolute height	5·4″	Occipital arc	5·0″
Basi-cranial axis from anterior margin of foramen magnum to naso-frontal		Minimum frontal width	3·8″
		Maximum frontal width	4·7″
		Maximum occipital width	4·5″

II. Measurements of Face.

Length of face: 'naso-alveolar' line	3″
Breadth of face: 'interzygomatic' line	5·05″
'Basio-subnasal' line, approximatively	4·05″
'Basio-alveolar' line, approximatively	4·05″
Height of orbit	1·4″
Width of orbit	1·65″
Length of nose	2·3″
Lower jaw, width of ramus on level of grinding surface of molar teeth	1·7″

III. Indices.

Length-breadth index: 'cephalic index'	68
Antero-posterior index	45
Facial angle to nasal spine	67
Facial angle to alveolar process	63

been effected here. This bone appears to have been more powerfully developed than is usually the case in skulls of this type, its angle having been square and everted and its coronoid having reached above the level of its zygoma. The mastoids are of an extraordinary length. There is a broad but shallow undulation on either side of a raised sagittal carina posteriorly to the coronal suture. Viewed in the norma verticalis, the skull is remarkable for the very gradual way in which it grows narrower along the long straight lateral boundaries from the barely recognisable region of the parietal tubera up to the external orbital processes of the frontal. This contour has been supposed[1] to characterise the Anglo-Saxon rather than the Celtic type of head; there is however no room for doubting that this cranium belonged to an inhabitant of this country in the Bronze Period. The skull is phaenozygous. The sagittal and coronal sutures are both obliterated internally, and

[1] See Professor Daniel Wilson, 'Canadian Journal,' New Series, vol. liv. Nov. 1864; or 'Anthropological Review,' vol. iii. Feb. 1865, London. The skull described on p. 175, under the name of Weaverthorpe, Smith, iii. 3, is of the type which, while equally long with the one described above, is distinguished by a sudden tapering in front of the parietal tubera, and is supposed by the writer just cited to be characteristic of the 'Insular Celt.' There is however no reason for holding that it belongs to a period anterior to that of the skull Langton i.

the sagittal is obliterated on the outside of the skull in the region where such obliteration usually shows itself first, viz. in the region of the foramina emissaria. On the right half of the frontal bone there is a wound 3″ long and 1″ wide, sloping downwards from a point, about an inch in front of the point where the sagittal meets the coronal suture, very nearly to the point where the temporal line passes from the lateral cranial wall on to the external orbital process. The floor of the wound is formed for a little over 2″ by the diploe, the cavities of which are filled with black earth of the same kind, apparently, as that which has given the entire exterior surface of the skull its dingy appearance. The outer table forms the lateral boundaries and the floor at either end of the wound. The inner table of the skull does not appear to have been affected by the blow, and the wound may be taken as an instance of 'un-depressed gouged out fracture,' for accounts of which kind of injury see 'United States Reports,' Circular No. 6, War Department, Surgeon-General's Office, Washington, p. 12, Nov. 1, 1865. A spear or celt of metal if driven with force at a living head might very well raise a splinter of bone out of the two external layers of the bony cranium, especially if the recipient was lying on the ground and rolled his head as much out of the way as he could as the blow descended. The splinter would probably, in the first instance, be left adhering to the scalp, and might have taken up its old place again. Here it has been lost; but that the patient survived its separation, at least from all connexion with the bone of which it once formed a part, the state of that bone furnishes fair evidence. On looking carefully with a lens at the edges of the wound formed by the external table of the skull, it will be seen that, though the meandering channels formed for themselves by plant rootlets have had something to do with making the surface what it is, still some process of smoothing down due to the vital operations of the skull itself is recognisable upon them. The lamellar arrangement of the outer table is still distinctly visible, nevertheless the surface is not as sharply defined anywhere as it must have been when the wound was first inflicted. To allow of this smoothing down being effected not more than two or three months would be required; in the very instructive histories given of the owners of skulls in the Berlin Museum (see Walter's 'Museum Anatomicum,' 1805, p. 468) which had had sword-cuts inflicted upon them, a process of healing

effected 'novo succo osseo affluente et annitente ut vulnus claudat' takes only 'paucos menses,' and in one case (2394) only two months. Yet this process is one requiring more time than the process of absorptive smoothing which is all we have signs of here. The unclosed vacuities in the diploe show that the wound was never healed, unless we are to suppose that the rootlets above mentioned have removed away cleanly and entirely that glaze of bone which in skulls so wounded is deposited over the injured area. The death of the man therefore, though occurring within a comparatively short time from the receiving of this wound, must have been due to some other cause than the mere wound itself.

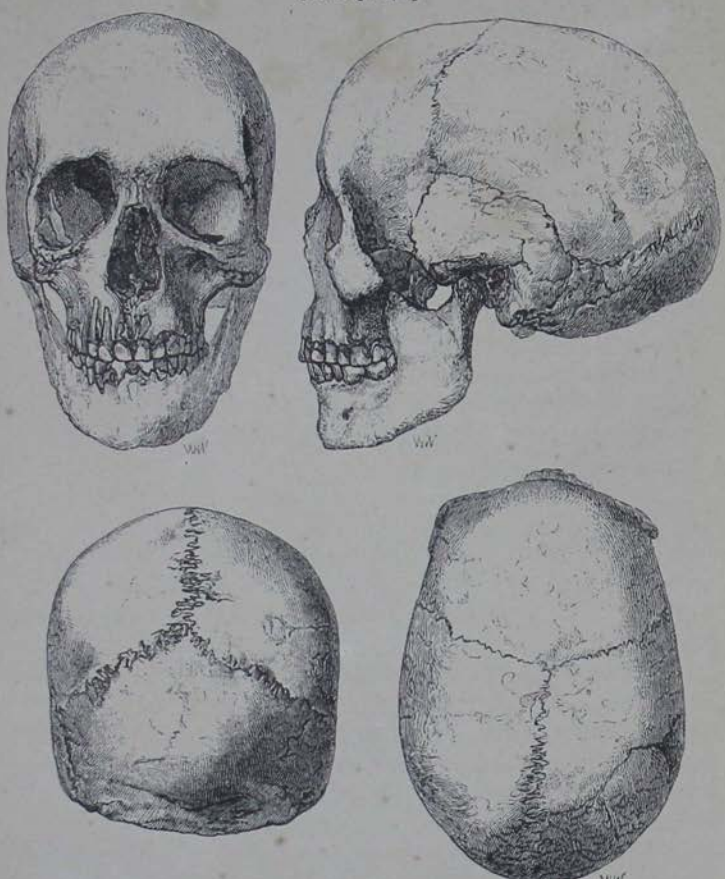
In the occipital norma the wall-sidedness of the lateral boundaries of the pentagon described by the contour lines in this aspect and the vertical carination characteristic of male skulls of this type are eminently noteworthy [1].

[1] A female skull, 'Langton Wold ii,' very closely resembling the one just described, has been obtained from the same barrow. It belonged however to a very much older individual, and some of the characteristics of its sex, which was established mainly by an examination of its trunk and limb bones, have been, as female cranial characters sometimes are, masked by the inroads of senile changes. It is interesting to note that the femora of this aged woman resembled those of this young male subject and those of the young woman next to be described, in having the spiral line joining the linea aspera and the anterior intertrochanteric line well marked. The aged female skull, 'Langton, ii. 2,' differs from both the others with which it has been compared in retaining the prominence of the parietal tubera so commonly observable in skulls up to the time when, with the evolution of the second set of teeth, the lower part of the skull widens out with the widening of the jaws. The absence of prominence of the region of the parietal tuberosities is one of the characters given by His and Rütimeyer as characteristic of the Hohberg type, an undoubtedly old form of skull; the presence of such prominence, on the other hand, is given by Schaafhausen ('Die Urform des menschlichen Schädels,' p. 7) as characteristic of priscan skulls. A consideration of these three skulls, taken together with that of some of the facts of skull-development, will show how these statements may be reconciled. The parietal tuberosities are as distinctively characteristic of the human cranium as is the lobule of the marginal convolution called 'lobulus tuberis' by Huschke ('Schaedel, Hirn, und Seele,' p. 142, 1854); the full distance between them (135 mill.) however, within some three millimeters, is attained to as early as ten years of age. See Welcker, 'Wachsthum und Bau,' p. 127. They are prominent in the skulls of quite young human subjects even of savage races, as *e.g.* the Australians and Indian Coles (see skulls mentioned in note on p. 214 infra), whilst on the other hand they are only very faintly indicated in the skulls even of the anthropomorphous apes. Further, it is, as might have been expected, a fact (see Weisbach, 'Archiv für Anthropologie,' iii. p. 71) that the intertuberal diameter is identical for the two sexes, or nearly so. It is now easy to see how female skulls which fail to attain the 'rounding out of the sides of the skull which occurs from the latest expansion of the brain' (see Cleland, 'Phil. Trans,' 1870, p. 149), and which retain in this particular

of comparative narrowness of the transverse diameter of the basis cranii (see Weisbach, l.c. p. 68), as in some others, childlike characters, will have their parietal tubera relatively prominent; and how ill-filled male skulls in ill-fed races may come to resemble them in this point. In well-filled male skulls, on the other hand, the prominence of the parietal tubera is lost in the general globosity produced by the widening out of the lower parts of the brain.

SHERBURN WOLD.

[vii. 1. p. 146.]



SKULL OF A WOMAN OF FROM THIRTY TO THIRTY-FIVE YEARS OF AGE, AND OF 4 FT. 8 IN. IN HEIGHT.

I. Measurements of Calvaria.

Extreme length	7·1″	Parietal arc	4·8″
Fronto-inial length	6·6″	Occipital arc	4·8″
Extreme breadth	4·9″	Minimum frontal width	3·3″
Vertical height	5·6″	Maximum frontal width	4·2″
Circumference	19·5″	Maximum occipital width	4″
Frontal arc	5″		

II. Measurements of Face.

Length of face	2·8″
Height of orbit	1·5″
Width of orbit	1·6″
Length of nose	2·2″
Width of nose	1″
Lower jaw, interangular diameter	3·3″
Lower jaw, depth at symphysis	1·3″
Lower jaw, width of ramus on level of grinding surface of molar teeth	1·3″

III. Indices.

Length-breadth index: 'cephalic index'	68
Antero-posterior index	46
Facial angle to nasal spine	63
Facial angle to alveolar edge	60

The condition of the femora and pelvis and of the teeth enables us to say with certainty that we have in 'Sherburn Wold, vii. 1' the skeleton of a woman who was of about the same age as, or perhaps a little older than, the man to whom the preceding skeleton ('Langton, ii. 1') belonged, i. e. about thirty or thirty-five years of age, and who was 4′ 8″ in stature. The femora are much slighter and much more curved, as well as much shorter, than those of 'Langton Wold, ii. 1;' they resemble them however in the curious point of having the inner of the two upper lips of the linea aspera prolonged spirally round into the anterior intertrochanteric line. The pelvis and sacrum are completed; the wisdom teeth however are comparatively little worn.

The verticality of the forehead and the absence of large supra-ciliary ridges are feminine characters, as are also the comparative feebleness of the lower jaw and the smaller size of the mastoids, seen in the profile view. The parieto-occipital slope however is a little more oblique than is usual in women's skulls. The pterygoids are perfectly vertical. In almost all its measurements this skull is smaller than the male skull with which it is compared; the more important, however, of the proportions which subsist between these dimensions are the same for both. The point of maximum width

is situated a little higher up than in the preceding skull, and the mesial vertical carina is less clear in the occipital pentagon. But it resembles that skull in the faintly marked parietal tubera and the absence of any rounding out of the lateral cranial walls below the level of those eminences. Viewed from above this skull presents a somewhat more tapering outline in both directions, both towards the forehead and towards the occiput, than the preceding one, and would have been more phaenozygous if the zygomatic arches had not been extensively lost. The sagittal and coronal sutures are more extensively obliterated than in the preceding skull, and the lambdoid, which was unaffected in that skull, is largely obliterated in this. There is a depression in the region of the left lateral fontanelle, the spot called 'asterion' by Professor Broca, and the maximum occipital width is half an inch less than in the other skull with which it has been compared. These points and the closure of the lambdoid may suggest that the occipital lobes ceased to grow early in life; their length however must have been great. In the norma basalis the absence of any crista transversa occipitis enables us to give a more favourable measurement to the fronto-postremal as compared with the frontal-inial diameter of the skull than in skulls where the commencement of the linea nuchae mediana is masked by a large development of that outgrowth. The palate is deep; the external alveolar border of the upper jaw is ellipsoidal; the disproportionate smallness of the upper wisdom teeth gives the inner border of the dental series a parabolic outline. There is a spot of caries on the right wisdom tooth in the lower jaw. The absence of any occipital spine enables us to see the distinctness of the curves described by the superior squama from those of the parietal above and the conceptacula cerebelli below, and produces the 'facettirte Absetzung des Hinterkopfs' dwelt upon as characteristic of the Hohberg type of skull. The absence of the process in question is however rather a sexual than an ethnographical difference; but it enables us to see the peculiar conformation of the back-head which is common to both sexes to great advantage.

RUDSTONE.

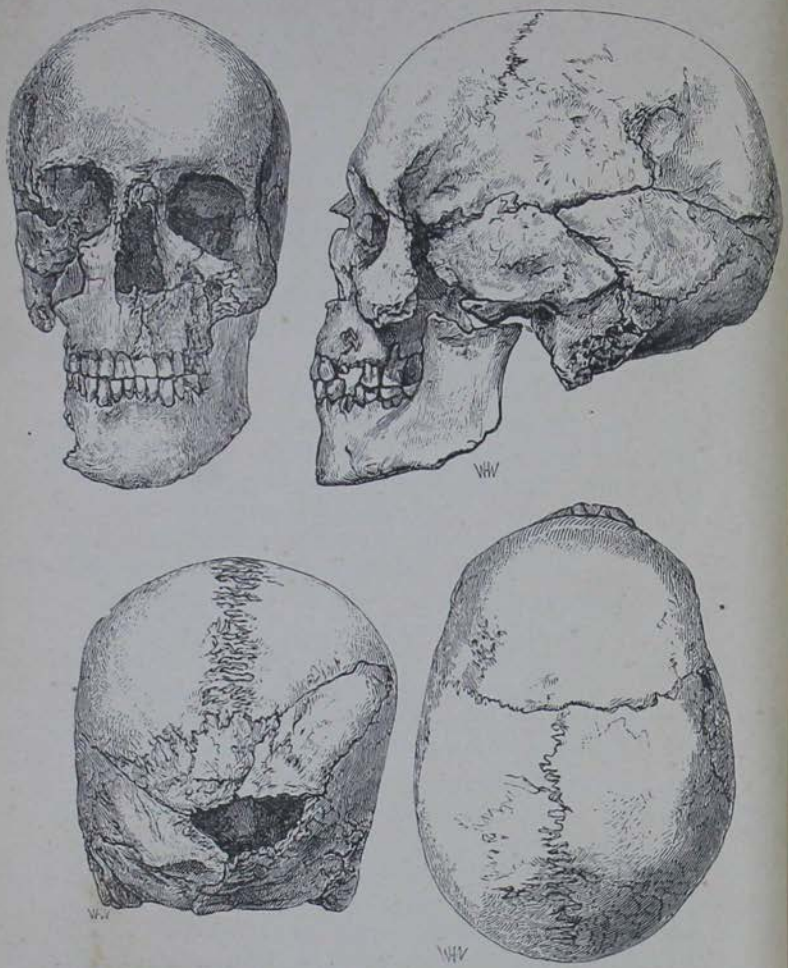
[ccxxiv. 4. p. 501.]

The lower jaw which has been drawn with this skull was not found in connexion with it, but was lying, in the long barrow whence it came, at no very great distance from it. It may very well have belonged to it, inasmuch as, though its colouration is somewhat different, it shows the same male characters; has a somewhat similar amount of wear upon the grinding surface of its teeth, which otherwise correspond in the way of co-adaptation to those of the upper jaw of the skull; and has been similarly channelled externally by rootlets. It has not been possible to say anything as to the long bones of the skeleton to which this skull belonged, but the skull taken by itself enables us to say positively that we have here to deal with the remains of a man 'past the middle period of life' who was probably of considerable muscular strength. The skull is eminently long and lofty, and specially interesting as showing how 'occipital dolichocephaly,' as here measured by drawing a line at right angles to the line of extreme length so as to lie as a tangent to the anterior border of the auditory foramen, is really dependent more upon the length of the parietal than upon that of the occipital bone. This is plain enough upon simple inspection of the skull in its norma lateralis; and it is shown, secondly, by the very small difference, only amounting to $\frac{2}{10}$ths of an inch, which subsists between the extreme length, 7·6″, and the fronto-inial length, 7·4″, taken to the commencement of the linea nuchae mediana; the measurements of the frontal, 5·2″, parietal, 5·4″, and occipital, 5·2″ arcs, are not so clearly indicative. Professor Jeffries Wyman[1] by a measurement of eleven normal crania obtained an average of 125 *mm.* (=4·92″) for the frontal arc, 124 *mm.* (=4·88″) for the parietal, and 117 *mm.* (=4·60″) for the occipital; whilst three adult synostotic crania gave for the frontal, parietal, and occipital arcs respectively 129·2 *mm.* (=5″), 142 *mm.* (=5·59″), and 119 *mm.* (=4·68″). Welcker[2] similarly obtained, as against an average from normal crania for the sagittal suture or parietal arc of 126 *mm.* (=4·96), an average from eleven skulls with premature obliteration of the sagittal suture

[1] See 'Observations on Crania,' p. 32, Boston, 1868.

[2] 'Wachsthum und Bau des menschlichen Schädels,' p. 15, 1862.

(Dolichocephali ex synostosi sagittali) of 137 *mm.* (=5·39″). His average from three 'scaphocephali' for the sagittal suture is 139 *mm.* (=5·47″). The skull now before us resembles those



SKULL OF A MAN PAST MIDDLE PERIOD OF LIFE.

measured by Wyman and Welcker in the great length of its parietal arc; but its occipital shows an equal excess over the

I. Measurements of Calvaria.

Extreme length	7·6″	Parietal arc	5·4″
Fronto-inial length	7·4″	Occipital arc	4·2″
Extreme breadth	5·4″	Least frontal width	3·9″
Upright height	6″	Greatest frontal width	4·7″
Circumference	20″	Greatest occipital width	4·1″
Frontal arc	5·2″		

II. Measurements of Face.

Length of face	3″
Depth of lower jaw at symphysis	1·7″
Width of ramus	1·5″
Height of orbit	1·45″
Width of orbit	1·6″
Length of nose	2″
Width of nose	0·9″

III. Indices.

Cephalic index	72
Antero-posterior index	40·9
Facial angle at nasal spine	68
Facial angle at alveolar border	61

normal. As its sagittal suture is closed along the inner table of the skull, though it is complexly denticulated externally, a condition of things observable in two other very closely similar skulls from the same locality, 'Rudstone, cexxiv. 1' and 'Rudstone, lxi. 3,' it is not possible to say whether here an elongation of the cerebral lobes produced the elongation of the brain case, or a premature sagittal synostosis produced an elongation of the brain in the way of compensatory outgrowth. An examination however of other similarly elongated calvariae from long and other barrows, as well as from interments of modern dolichocephalic savage races, puts it beyond a doubt that the elongation of the brain is the first term in the series, and that the synostosis observable in such skulls as these is not a cause but a consequence merely, the sutures closing because the brain does not grow in the direction at right angles to their long axis[1].

[1] A calvaria from the long barrow at Upper Swell, mentioned at p. 528 of 'British Barrows,' as found under the skull 'No. 2, Upper Swell,' has a parietal arc of 5·9″, being one inch longer than the normal length of this arc, with a frontal of 5·1″ and an occipital of 4·9″, *with both frontal and sagittal sutures open both internally and externally and for their entire lengths.* The sex of the owner of this calvaria cannot be spoken to positively; the age however must have been somewhere between sixteen and twenty, and probably nearer the latter than the former of those years, the sphenoidal sinuses being largely developed, and the spheno-basilar synchondrosis entirely closed. In this latter particular this skull is a more striking example in illustration of the view given

The elongated oval contour of the vertical norma and the pentagonal of the occipital are very characteristic. In the frontal norma the great relative development of the alveolar, as opposed to the mental portion of the front of the lower jaw, is very striking. In this, as also in the backward position of its foramen mentale in a plane corresponding to that of the last premolar, this lower jaw resembles many other lower jaws of skulls of this period. It is however a larger and powerful bone, as, it must be said [1], many lower jaws from very early burials have been found to be. The canines are greatly developed in both jaws, and give a squareness to the lower part of the face. There has been much decay of the teeth, and alveolar abscesses with the left upper premolars and wisdom tooth.

above than the skull from Norton Bavant, adduced in favour of that view by Dr. Thurnam *, in which the spheno-basilar suture was still open.

Four other dolichocephalic skulls were obtained from the same barrow of Upper Swell, in which the sagittal suture was patent, though they had belonged to as old or older individuals, but in them the parietal arc though long is not so long as in the one spoken of above. The same remark applies to some adult Eskimo skulls in the Oxford University Museum; and two skulls in the Oxford University Museum (representative of two other races in which the boat-shape, denoted by the title 'Scaphocephalic' or 'Cymbocephalic,' is very eminently and very frequently represented, the Australian, namely, and the Coles of India), the elder of the owners of which cannot have attained more than sixteen years of age, whilst the younger was only ten years old, have each attained that shape with every suture patent throughout. In like manner the Gentoo skull, No. 5558 in the Museum of the Royal College of Surgeons of England, with every suture open, is all but identical in its outlines with the Gentoo skull 5556, which is 'synostotic.' Per contra, in brachycephalic skulls of the Bronze as of other periods the coronal suture is far too frequently open throughout to allow us to suppose that its synostosis has, when present, been the cause of the skull's shortness.

[1] Though the lower jaw figured with an ancient British skull from a barrow at West Kennet, North Wilts, pl. 50, 'Crania Britannica,' and stated by Dr. Thurnam, in loco, 'to deviate considerably from the normal type,' does, as I convinced myself by an examination of it in the Cambridge University Museum, most undoubtedly belong to some quite modern skull, still similarly powerful jaws have not rarely been found with very ancient skulls. Such were the lower jaws found by Schmerling in the Engis Cave, see Virchow, 'Archiv für Anthrop.,' vol. vi. p. 90; and in the cairn of Get, Caithness, as recorded by C. Carter Blake, Esq., 'Mem. Anth. Soc.,' vol. iii. p. 243.

* See 'Mem. Soc. Anth. London,' vol. iii, or 'Further Researches,' separate copy, p. 31. Also ibid., vol. i, separate copy, p. 69; and 'Nat. Hist. Review,' p. 242, 1865; and Virchow, 'Archiv für Anthropologie,' vol. v. p. 535, 1872.

HELPERTHORPE.

[xli. 3. p. 191.]

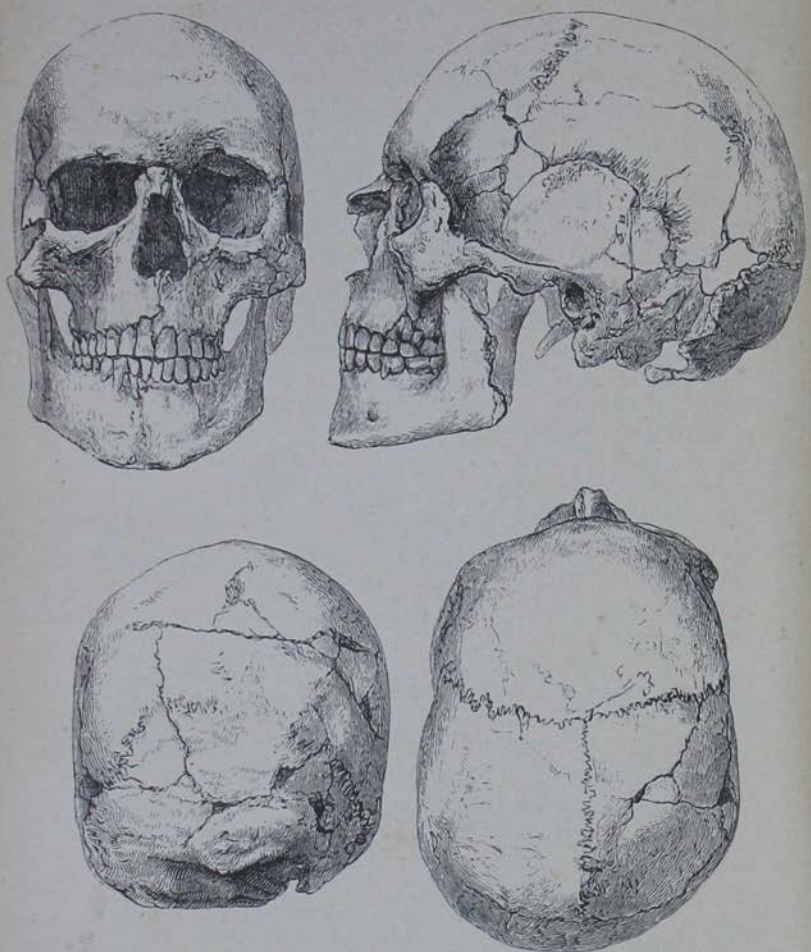
The skull 'Helperthorpe, xli. 3,' is one which, except for a certain asymmetry in its parieto-occipital region and a certain wall-sidedness in its lateral temporal regions, might have passed, if we were not acquainted with its archaeological surroundings, for a modern skull. The curve described by its mesial antero-posterior contour from the moderately developed supraciliary ridges to the middle of the superior squama occipitis is much more equable than is usual even in dolichocephalic skulls; and the comparatively small development of the frontal sinuses and supraciliary ridges makes us hesitate in ascribing any of the retreating of the frontal region to the commencement of senile gravitation-changes. The difference between the fronto-postremal length and the fronto-inial length, measured in this case to the commencement of the linea nuchae mediana, which is distinguishable from the external occipital protuberance, is only $\frac{1}{10}''$; and the dolichocephaly of the skull depends upon the length of the parietal bones; the length of the parietal arc, 5·5″, being more than half an inch over the average, whilst that of the occipital, 4·6″, is identical with it. The mastoids are large, the jaws orthognathous, the lower jaw well formed, lying evenly on a horizontal plane, with a bifid mentum, a long coronoid, and a square angle. The nasals are saddle-shaped, the nose in life may have been, judging from the rise of these bones distally, a 'Roman' one; but at any rate it must have differed from the all but Grecian profile given to the Celtic face in the *Æs grave*[1] of Rimini, a work of art of probably the fifth century B.C.

In the norma verticalis this skull presents a bluntly oval contour, remarkable for very considerable asymmetry[2] on the right half of the parieto-occipital region, due probably to the mode of carriage

[1] See Frontispiece to 'Ethnogénie Gauloise, par Roget Baron de Belloguet,' 1861; Sambon, 'Recherches sur les Monnaies antiques de l'Italie,' 1870, p. 71. The backward position of the ear in this figure is nearly as clear an indication of its having been intended for a representation of a brachycephalic head as the torc round the neck is of its having been intended for a Gaul of early Roman history.

[2] For a discussion upon the mode of production of such asymmetry, see note, pp. 176, 177, supra ibique citata.

in infancy. This distortion is less common in the dolichocephalic than in the brachycephalic variety of crania, both in ancient and in modern times. The posterior part of the sagittal and the upper



SKULL OF A STRONG MAN PAST MIDDLE PERIOD OF LIFE.

part of the lambdoid sutures are extensively obliterated, both externally and internally. As in many skulls with long parietals,

I. Measurements of Calvaria.

Extreme length	7·7″	Frontal arc	4·9″
Fronto-inial length to linea nuchae mediana	7·6″	Parietal arc	5·5″
Extreme breadth	5·4″	Occipital arc	4·6″
Vertical height	6·2″	Minimum frontal width	3·9″
Circumference	21·5″	Maximum frontal width	4·8″
		Maximum occipital width	4·8″

II. Measurements of Face.

Length of face: 'naso-alveolar' line	2·8″
Height of orbit	1·5″
Width of orbit	1·7″
Length of nose	1·9″
Width of nose	1″
Lower jaw, depth at symphysis	1·9″
Lower jaw, width of ramus on level of grinding surface of molar teeth	1·45″

III. Indices.

Length-breadth index: 'cephalic index'	71
Antero-posterior index	51
Facial angle to nasal spine	75
Facial angle to alveolar edge	70

the apex of the lambdoid suture forms a widely open angle. The parietal tubera are well marked, and one of them is the seat of an exostosis; the walls of the skull below widen only very slightly as they pass down to the mastoids; the point however of maximum width lies below that of the parietal tubera and on a level with the posterior and superior angle of the squamous. A dilatation in the line of an accidental fissure running about midway between the upper and lower borders of the left parietal bone marks the exact position of the parietal tuberosity of that side; which, as is the rule in skulls of this type, is seen to be both further forward and lower down than it, with the part of the brain which it covers (for which see Huschke, l. c. p. 142), would be in brachycephalic forms. The upper lineae semicirculares for the origin of the temporal muscles are plainly seen above the parietal tubera.

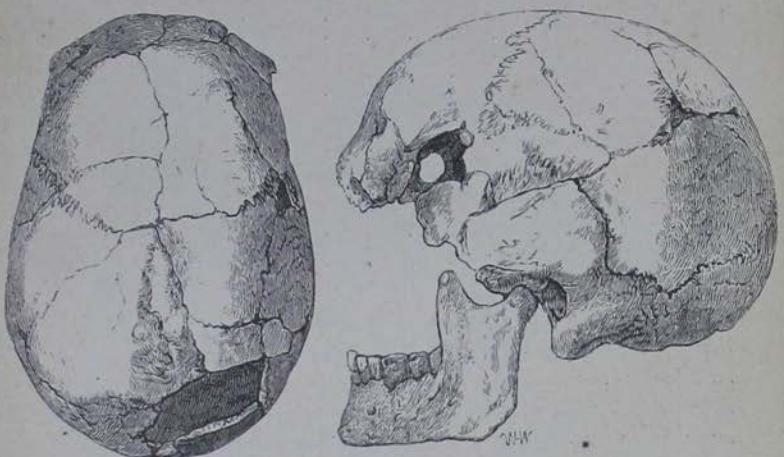
WEAVERTHORPE.

[xliv. 3. p. 198.]

The calvaria and lower jaw, 'Weaverthorpe, xliv. 3,' may firstly be taken to illustrate the fact that a type existed in the Bronze Period which is recognisable amongst modern Celtic populations; and, secondly, may throw some light upon the various

questions which have been raised as to the famous skull from the cave at Engis, as it resembles that skull in many important particulars.

In the profile view we have the characteristically equable dolichocephalic curve, beginning after a vertical course for a short distance above the upper edge of the supraciliary ridges,



CALVARIUM AND LOWER JAW OF A MAN PROBABLY IN MIDDLE PERIOD OF LIFE.

I. Measurements of Calvaria.

Extreme length	7·8″	Frontal arc	5·4″
Fronto-inial length	7·5″	Parietal arc	5·4″
Extreme breadth	5·3″	Occipital arc	4·7″
Vertical height	5·6″	Minimum frontal width	3·6″
Circumference, approximatively	21·2″	Maximum frontal width	4·4″
		Maximum occipital width	4·3″

II. Measurements of Face.

Lower jaw, depth at symphysis	1·2″
Lower jaw, width of ramus on level of grinding surface of molar teeth	1·45″

III. Indices.

Length-breadth index: 'cephalic index'	69
Antero-posterior index	53

and sweeping round to the centre of the superior occipital squama, which then bends downwards and forwards to a transversely running but not largely developed protuberantia externa, which is dis-

tinguishable from, though continuous with the commencement of the linea nuchae mediana in a tuberculum linearum. The frontal length taken to this last point is shorter than the extreme length taken to the centre of the occipital squama by as much as $\frac{3}{10}$ths of an inch. The mastoids are largely developed, and what is of some importance to state, as the sex of the Engis calvaria has been supposed to be female, these processes, which in the Engis specimen are only imperfectly represented, taken together with the lower jaw, which in the case of the Engis calvaria has not been identified, leave no doubt as to the sex of their owner having been male. Had this calvarium been as imperfect as is the Engis, there would have been more justification than there is in the case of that specimen for suggesting that it may have belonged to a woman. There is no doubt that the lower jaw belonging to this skull justifies us in speaking of its owner as having been a strong male subject, its angle, mentum, and coronoid being all alike powerfully developed, and its ramus showing on its lower edge the undulation anterior to its angle and the ridges on the internal surface of that area which are distinctive of muscular men. The one wisdom tooth, remaining on the left side, shows some wear from use upon its two anterior cusps, the absence however of wear upon the posterior may perhaps have been due to the absence of any wisdom tooth on the left side above, a point which cannot now be determined. The other teeth are much worn, the mastoids are very large, and, though the sutures are often very extensively obliterated in skulls of this type before middle life, their very extensive obliteration here, both internally and externally, coupled with the two other points just specified, makes it safe to speak of this skull as one of a man of at least the middle period of life. In the norma verticalis this skull is seen to taper somewhat rapidly forwards from the point of maximum width which lies in the plane of the mastoids, but on the level of the upper edge of the squamous; it tapers even more rapidly backwards, as the measurement of the extreme occipital width shows when compared with the measurement of extreme width; a depression existing on either side at the 'asterion' or site of the posterior lateral fontanelle. The contour consequently presented by this skull when viewed from above is that described[1] by Professor

[1] 'Canadian Journal,' New Series, vol. liv. p. 393, Nov. 1864; and Dr. Beddoe, 'Mem. Soc. Anth. London,' vol. ii. p. 349.

Daniel Wilson as characteristic of the 'Insular Celt,' and called by him 'pear-shaped' or 'coffin-shaped.'

Skulls, it may be said with truth, very closely similar to this skull and to the Engis skull have, like it, been found in caves; three strikingly like them; one from the mountain limestone cave at Llanebie in Caermarthenshire, mentioned by Dr. Buckland, Reliquiae Diluvianae, p. 166[1], and filled with stalagmite; a second from a cave at Cheddar; and a third, presented by James Parker, Esq., from a small cave at Uphill, near Weston-super-Mare; all, of considerable, though, as is often the case with other objects of the same kind from the same sort of locality and deposit, of uncertain antiquity, may be seen in the Oxford University Museum. But very similar skulls are to be found in perfectly modern interments. The Engis skull has been compared by its discoverer Professor Schmerling[2] and by Professor Virchow[3] to Æthiopian skulls; and by other authorities to Eskimo and Australian skulls. Principal Dawson[4], F.R.S., of McGill College, Canada, remarked to me of a skull of the dolichocephalic variety of the Red Indian race and of the Iroquet tribe from Hochelaga near Montreal, that it resembled the Engis cranium, and as this cranium has been presented to the Oxford University Museum it is available there for comparison with a cast of that famous calvaria. Resemblances so strong as are some of these should, since they are also so widely scattered over the globe, make us careful in speaking as to the ethnographical affinities of any calvariae, or even, inasmuch as the absence or presence of prognathism varies a good deal within the limits of a single race, of skulls, until we have a very considerable number of representatives of both objects of comparison to place alongside of each other; and it may be added until we have also succeeded in bringing other lines of evidence from archaeology, philology, and, when available, history, to bear upon the question[5].

[1] An account of this cave, with a figure, may be found in Mr. L. W. Dillwyn's 'History of Swansea,' p. 52, and may be advantageously compared with M. Dupont's similar discovery near Grendon, recorded at p. 229 of his work, cit. p. 537 of 'British Barrows.'

[2] 'Recherches sur les ossements fossiles découverts dans les Cavernes de la Province de Liége,' p. 59 seqq., 1833. Cit. Professor Huxley, 'Man's Place in Nature,' p. 121, 1863.

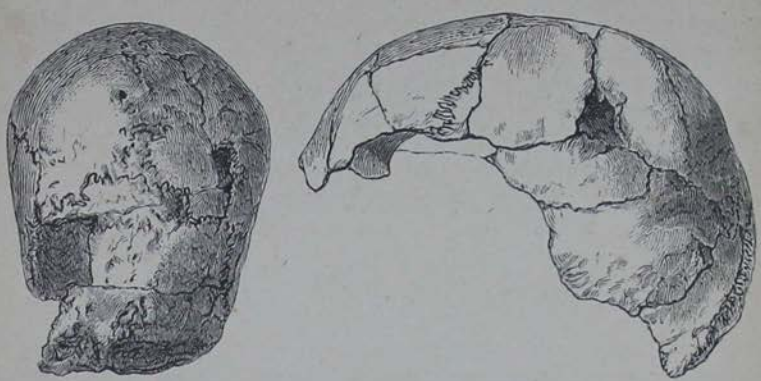
[3] 'Archiv für Anthr.,' vol. vi. p. 92, 1873.

[4] 'Canadian Naturalist,' vol. v. No. 6, Dec. 1860.

[5] [The Editor described ('Quart. Journ. Science,' April, 1864) a skull from St. Acheuil, near Amiens, which closely resembled in form and proportions the Engis cranium.]

EBBERSTON.

[No. III.]



CALVARIA OF PROBABLY A WOMAN IN OR PAST THE MIDDLE PERIOD OF LIFE.

Measurements of Calvaria.

Extreme length	8·3″
Fronto-inial length	
Extreme breadth	4·6″
Vertical height	6″
Frontal arc	5·1″
Parietal arc	5·5″
From upper surface of external occipital protuberance to posterior edge of foramen magnum, approximatively	1·7″
Occipital arc to upper surface of external occipital protuberance	2·5″

The very imperfect calvaria, 'Ebberston iii,' has been described by Dr. Thurnam in the 'Archaeological Journal,' vol. xxii. 1865, and also in the 'Memoirs of the Anthropological Society of London,' vol. i. It has suffered very much from posthumous pressure, and the measurements given of it must be taken as being merely approximative. Still, there is abundant evidence furnished by its form in its present condition for saying that it formed part of an exaggeratedly dolichocephalic skull to which the name 'cymbocephalic,' proposed by Professor Daniel Wilson[1] in 1850, may very appropriately be applied. No limb nor trunk bones have been assigned to this calvaria, and some doubt may exist as to the sex of its owner; it is most probable perhaps

[1] See 'British Association Report for 1850,' p. 142.

that it belonged to a woman. As regards the age of its owner, there is also room for doubting whether the full term of sixty years assigned by Dr. Thurnam had really been attained to. All the sutures are 'ossified and nearly effaced' in some dolichocephalic skulls from long barrows and of this period, e. g. 'Rudstone, ccxxiv. 1,' a skull from the same long barrow as 'Rudstone, ccxxiv. 4' described above, whose owners had certainly not attained half that age. Comparatively little however need or ought in this case to be staked upon a determination of these two points of sex and age.

The denticulations of the posterior fifth of the sagittal suture can be seen, in spite of the closure of the suture, to have been long and complex, as they often are in these synostotic skulls; in the penultimate fifth the suture is entirely obliterated, and its course is partly occupied by a nodular exostosis, to the left of which a large foramen emissarium is to be seen; the rest of the suture is barely traceable. The squamosal suture however and its additamentum have escaped anchylosis; and the coronal suture is complexly denticulated on both sides.

The frontal bone is slightly carinate over the segment corresponding with the junction of its 'facies frontalis' with its vertical aspect. The sites of its tubera are scarcely identifiable, though those of the parietal can still be recognised. The ectorbital process which is preserved is strong, the frontal sinuses are only moderately developed.

Among the fragmentary bones from the Ebberston long barrow there came into my hands a portion of a lower jaw which combined, as jaws from these barrows not rarely do, great thickness in the molar region together with [1] a feebly developed chin. If this jaw, or one equally weighty, belonged to this skull, as it may very possibly have done, we may then explain the fact of the low and retreating forehead by a reference to the principle of balance already (p. 190) referred to; a very low basis cranii may also have contributed to its formation. It may have been to skulls like this that Sir Richard Colt Hoare [2] referred when speaking of crania from a long barrow at Stoney Littleton in the county of Somerset as being 'fronte valde depressa.'

[1] Also a canine with socket bifid for a doubly fanged tooth.

[2] 'Archaeologia,' vol. xix. p. 46, 1821.

XVI.

GENERAL REMARKS UPON THE PRECEDING SERIES OF PREHISTORIC CRANIA FROM 'BRITISH BARROWS.'

A LARGE series of skulls from prehistoric burial-places in the north of England, and chiefly in the East Riding of Yorkshire, having, together with many others from other localities, been presented to the Oxford University Museum by the Rev. William Greenwell, F.S.A., I undertook to select a certain number of these skulls for figuring and description. There is room for the addition of some general remarks to the account contained in the preceding chapter of the craniography of the skulls thus selected, a considerable quantity of additional material having come into our hands during the time which has elapsed since the commencement of this work.

A craniographer with Canon Greenwell's series before his eyes in a *coup-d'œil* view would be impressed with the fact that out of the series, two sets, the one by its length typically illustrative of the dolichocephalic, the other by its breadth as typically illustrative of the brachycephalic form of skull, could at once be selected, even by a person devoid of any special anatomical knowledge. An antiquary similarly inspecting this series with a knowledge of its archaeological history would, if he separated it into two groups, the one containing all the skulls of the stone and bone age, the other containing all those of the bronze period, perceive that, while the latter group comprised both dolichocephalic and brachycephalic crania and in very nearly equal proportions, none but dolichocephalic skulls were to be found in any set of skulls from the barrows of the premetallic period [1].

[1] Sir William Wilde, in a lecture on the Ethnology of the Ancient Irish, delivered at the College of Physicians in 1844 and originally published in the 'Dublin Literary Journal,' promulgated the idea that two races, one dolichocephalic, the other

Facts of nearly equal generality and obviousness would be presented in the observation of the comparative rarity of the inter-

a round or globular headed race, existed in that country in the earliest times, apparently simultaneously. Examples of both races, but especially of the former, he thought were still to be found among the modern Irish. The evidence before Sir William Wilde is given at pp. 40, 228–232 of his 'Beauties of the Boyne and Blackwater,' the second edition of which was published in 1850. In this year Professor Daniel Wilson, in a paper read before the British Association and published in the 'Transactions' of the Sections for 1850, p. 142, put forward the following statement as to the succession of races in Scotland, in opposition to the views of Professor Nilsson which may be found in the 'British Association Report for 1847' at p. 31: 'The earliest Scottish race differed entirely from the earliest Scandinavian race as described by Professor Nilsson, being rather dolichocephalic, or perhaps more correctly cymbocephalic, to adopt a term which I venture to suggest as most appropriate to the peculiar boat-like shape of the crania. . . . . The second race decidedly corresponds with the brachycephalic of Retzius, though in the few examples I have been able to obtain the cerebral development appears considerably greater than in the primitive race of Scandinavia.' These races Professor Daniel Wilson appears to have considered to be Preceltic; and of the 'true Celtic type,' he says, 'nearly all ethnologists are agreed in assigning to it an intermediate form, shorter than the true dolichocephalic and longer than the brachycephalic.' These views were expounded by him at greater length in the first edition of his 'Prehistoric Annals of Scotland,' pp. 163–187, 695–696, which was published next year; cit. Nott and Gliddon, 'Indigenous Races,' p. 293. With Professor Wilson's conclusion that the earliest race in Great Britain was eminently dolichocephalic, and I would add exclusively so, all archaeological anatomists are now agreed; and the tendency to extend this conclusion to other regions of the world's surface is now so strong as to have suggested a comparison between the progress from dolichocephaly to brachycephaly, which is taken for granted, and the gradual widening of the skull, which, it is asserted, takes place between childhood and adult age in modern races. See Schaafhausen, 'Urform menschl. Schädels,' p. 5, 1868, or as cit. Welcker, 'Archiv für Anthropologie,' i. p. 151, 1866.

Professor Wilson's views were adopted by Mr. Bateman in his 'Ten Years' Diggings,' p. 147, published in 1861; and he himself reaffirmed them in his paper on 'Ethnical Forms and Undesigned Artificial Distortions of the Human Crania,' published in the 'Canadian Journal,' No. xli. Sept. 1862, p. 41, and in his paper on 'Ancient British Skull Forms,' published in the 'Edinburgh Philosophical Journal,' vol. xviii. July, 1863, p. 62 seqq.

Still Professor Nilsson's views as to the priority of the brachycephalic races maintained their hold upon the beliefs of the great majority of at least continental anthropologists until the publication of Dr. Thurnam's memoir on 'The Principal Forms of Ancient British and Gaulish Skulls' in 1865, in the 'Memoirs of the London Anthropological Society.'

Professor Broca, 'Bull. Soc. Anth. Paris,' ser. ii. tom. viii. 1873, p. 827, in his memoir 'Sur les crânes de Solutrè,' thus sums up the present state of opinion upon this question: 'En effet dans les gisements les plus anciens de l'Europe occidentale, tous les crânes sont dolichocéphales, et dans les gisements moins anciens qui ne remontent qu'à l'âge du renne, la dolichocéphalie est encore la règle la plus générale; quelques faits, il est vrai, établissent qu'à cette dernière époque il y avait eu outre une race au crâne plus arrondi;' some Solutrè, like some Hungarian, skulls contravening this rule.

I do not know what foundation there may be for the statement of Professor

mediate forms, the 'Misch-Formen' of the German anthropologists, in the slightness and shortness of many of the limb bones of the skeletons of the earlier periods, in the very frequent appearance of a certain 'ill-filledness' in the skulls appertaining to those skeletons, and an equally frequent ruggedness in the skulls of the later ages, and finally in the presence, in both series, of skulls which, while retaining their respective type, were very much smaller than the great majority of those classified with them.

Questions of some difficulty as to the affinities of these two sets of crania to those of contemporaneous, of succeeding, and of still existing races of mankind, are suggested by an inspection of them

Canestrini, given by Mr. Darwin, 'Descent of Man,' p. 39, 2nd edition, to the effect that brachycephalic crania have been found in the Drift. The cranium from Olmo in the valley of the Arno, supposed to belong to the post-pliocene age, was said to be brachycephalic, but has been shown by Professor Broca to have an index of 72·72, i.e. to be distinctly dolichocephalic. See his 'Mémoires,' tom. ii. p. 354, 1874.

Professor Nilsson, in the third edition of his 'Primitive Inhabitants of Scandinavia,' the first edition of which was published in 1838, says at p. 121 of the English translation, edited by Sir John Lubbock, 1868, 'Some isolated brachycephalous crania have been occasionally found in our stone sepulchres; but it may be taken for granted that the people who constructed these sepulchres belonged to one of the dolichocephalous races which still inhabit the greater part of the country.'

Baron von Düben ('Compte Rendu, Congrès internat. d'Anthropologie,' Stockholm, 1874, tom. ii. 1876, p. 691), speaking of these brachycephalous skulls, says, 'Parmi les cent crânes que j'ai examinés du Danemark et de la Suède il s'en trouve une dizaine de cette forme, dont 5 du Danemark et le reste de la Suède depuis la Scanie jusqu'en Vestergötlande. Ils ont tous été exhumés des tombeaux de l'âge de la pierre, les crânes sont très arrondis, très courts, d'un indice allant jusqu'à 84·2. Grâce à cette forme ils contrastent au premier abord et fortement avec les autres crânes qui sont dolichocéphales, et évidemment ils appartiennent à une race différente. Ce sont les crânes que MM. Nilsson et A. Retzius ont attribués aux Lapons; et certainement quelquesuns de ces crânes ressemblent tellement à ceux des Lapons que nos connaissances crâniologiques actuelles ne suffisent pas pour y constater des différences. Cependant d'autres faits montrent que les Lapons ont immigré par le nord de la Baltique et qu'ils n'ont jamais habité la péninsule Scandinave audessous du 62°. Par cette raison il faut attendre avant de décider sur ce point. Au reste, si ce sont des Lapons, il se peut très-bien qu'ils soient arrivés comme esclaves ou comme amis de la race dolichocéphale établie de l'autre côté de la Baltique, où vraisemblablement ont existé aux temps préhistoriques des relations intimes entre les Lapons et les races gothiques.'

As already stated, p. 189, there appear to me, so far as an examination of various casts, figures, and descriptions enables me to form an opinion, to be two forms of brachycephalic skulls reported to have been found in Danish tumuli of the stone period. I cannot however perceive any close resemblance between either of these forms and that of any one of several Lapp crania which the University Museum owes to the kindness of Professor Eichwald and Mr. A. J. Evans, F.S.A., of Brasenose College. See also infra, p. 264.

in connexion with some other skulls; and with these questions is intimately connected the choice of the name, whether 'Iberian' or 'Silurian,' 'Brigantian' or 'Cimbric,' which we may for the sake of convenience impose upon the one or the other variety of skull.

The effects which the mode of life possible to the inhabitants of this country in the earlier and indeed also in the later of the two periods of stone and of bronze, with which we have to deal, exercised upon their bodily structure, form a further subject for thought and enquiry, the materials for the prosecution of which however, being limited to the bones and teeth, are, from the point of view of a pathologist, comparatively scanty. Something has also to be said as to the sources whence the food of these races came, whether from domestic or from wild animals exclusively, or in combination with each other and with agricultural produce.

It will be convenient to begin by saying that I should speak of the crania of the long-barrow period, not as belonging to the 'Iberian[1],' as it is becoming the fashion to style them, but as belonging to the 'Silurian' type; and the brachycephalic crania of the round barrow I should similarly speak of, not as belonging to a 'Ligurian,' but to the 'Cimbric' type.

Tacitus, Agricola, xi, tells us that there was a tribe of people called Silures living in the district which we know now as the South Welsh counties of Glamorgan, Monmouth, Brecknock, Hereford, and Radnor; he tells us further, as a matter of fact, that the complexion and hair of this tribe could be described as 'colorati vultus, torti plerumque crines,' words which Jornandes alters slightly, making them a little clearer but perhaps less accurate, as (Get. 2) 'Silurum colorati vultus, torto plerumque crine et nigro nascuntur.' And we know that the black-haired type of the West

[1] The earliest paper with which I am acquainted in which this name was adopted for one division of the population of Great Britain is a paper, not without its merits, by Dr. Hibbert Ware, to be found in the 'Proceedings of the Royal Society of Edinburgh,' vol. i. March 4, 1844. Keyser, in a letter of date April 21, 1847, addressed to Retzius and published by him in 'Müller's Archiv,' 1849, or see 'Ethnol. Schrift.' p. 103, 1864, suggests that the Iberians may have been the primitive stone-age inhabitants of Great Britain and Ireland. This stock was then considered to be Turanian and brachycephalic. Weinhold, who in his 'Altnordisches Leben' had called the stone-age race 'Finnish,' adopted the name 'Iberian' in his memoir 'Die heidnische Todtenbestattung in Deutschland,' published in the 'Sitzungsberichte d. K. Akad. d. W. phil. hist. Cl. Wien.' bd. xxix. hft. 2. p 131.

of England at the present day[1] is shorter in stature and feebler in development, and at the same time longer in skull-form than the lighter haired and lighter complexioned variety. Therefore the longer skulls found with shorter skeletons, but in the long barrows and there to the exclusion of brachycephalic forms, I should speak of as belonging to this 'Silurian' type.

The brachycephalic skulls of the bronze period which, as already stated, are found in the round barrows mixed up with long skulls, I shall speak of as belonging to a 'Cimbric' type; firstly, because there is no doubt that a similar form of skull is found at the present day to be the skull form of the inhabitants of Denmark, once called the 'Cimbric' Peninsula[2]; and, secondly, because, as I have elsewhere pointed out[3], there are other reasons for thinking

[1] Dr. Beddoe, 'Mem. Anth. Soc.' vol. ii. p. 350.

[2] Dr. Beddoe, 'Mem. Anth. Soc.' vol. iii, and Handelman und Pansch, 'Moorleichenfunde,' p. 26. The skull-form of the Danes was eminently brachycephalic 800 years ago also, if we may judge from the skulls of Flambard and some other distinguished ecclesiastics of the early Norman period in this country. These skulls were exhumed and, after being measured by me, reinterred in the course of certain excavations close to the cathedral in Durham in 1874. The skulls of the Anglo-Saxon interments disturbed in these excavations were of the dolichocephalic type usual in that race.

[3] See 'British Association Report' for 1875, Bristol Meeting, pp. 148–149, where it is suggested that in addition to the *a priori* probability which the fact of so many immigrations from Denmark into Great Britain having taken place in the way of invasions in historic times lends to such a view, we have some more definite likelihood given to it by the discovery in Yorkshire of monoxylic coffins with similar contents and fashion to those found in South Jutland; and by the existence in the same country of earth-works, which remind us of the 'castra ac spatia' of the Cimbri in their native land (Tacit. Germ. 37), but which have been shown by Colonel Lane Fox to have been thrown up by invaders advancing inland from the sea. I was not aware when I made these suggestions that Münch in his 'Det Norske Folks Historie,' p. 11, German translation by Claussen, 1853, had drawn an argument for the same suggestion from the words of Ammianus Marcellinus, xv. 9, relating to one of the 'Cimbric Deluges,' taken in connexion with the well-known words of the Welsh Triad, 4. p. 57, cit. Sharon Turner, 'History of the Anglo-Saxons,' vol. i. book i. chap. ii. and iii. pp. 32, 42, 48 and 49, 7th ed. 1852, which say that Hu Gadarn 'led the nation of the Cymry first to the isle of Britain; and from the country of Summer which is called Deffrobani they came; this is where Constantinople is; and *through the hazy ocean* (the German Ocean) they came to the island of Britain.' Whatever may be the value of these words from the Triad, it is of importance to recollect that there are geological reasons for holding that the so-called 'Cimbrian Deluge' was but one of a series of submersions each of which may have caused an emigration. Sir Charles Lyell has recorded an opinion to this effect in his 'Principles of Geology,' vol. i. pp. 558, 559, citing the traditions recorded by Strabo, vii. 2, and Florus, iii. 3, as to the occurrence of such catastrophes in the Cimbric Peninsula, and in 'extremis Galliae.' Other references to the Cimbric Deluge will be found in Professor Nilsson's 'Early

that the tribes who brought bronze into England, with the fashion of burning or burial in round as opposed to long barrows, may very

Inhabitants of Scandinavia,' ed. Lubbock, pp. 252–259, in Maack's 'Das urgeschichtlich Schleswig-Holstein Lande,' Berlin, 1860, also in Koner's 'Zeitschrift für Erdkunde;' in Pallmann's 'Die Cimbern und Teutonen,' Berlin, 1870, pp. 27, 28, 32, and Duncker's 'Origines Germanicae,' 1840, p. 99. It may be well here to give the exact words of Ammianus Marcellinus, which, as he is not referred to by Sir Charles Lyell, are not so well known to English readers as they deserve to be. Writing of the Gauls he says, xv. 9. 4, p. 56, ed. Eyssenhardt, Berlin, 1871, 'Drasidae memorant re vera fuisse populi partem indigenam, sed alios quoque ab insulis extimis confluxisse et tractibus transrhenanis, crebritate bellorum et adluvione fervidi maris sedibus suis expulsos.' Münch supposes that two waves of population passed over into Britain from the Continent in prehistoric times, and that the Gael were the earlier and the Cymry were the later in order of invasion. This view, or one closely approximating to it, is the one usually taken by writers on this subject, as for example by the present Bishop of St. David's ('Vestiges of the Gael in Gwynedd,' p. 48, 1851), and by Niebuhr ('History of Rome,' vol. ii. Eng. Trans., p. 522 seqq.), Thierry ('History of the Norman Conquest,' book i), E. Lluyd, and to some extent by Prichard ('Phys. Hist.' iii. ed. 3, p. 150), cit. in loco; and O'Brien (Preface to Irish Dictionary), referred to by Prichard. Many writers have laid much weight upon the similarity of the names *Cimbri* and *Kymry* as an argument for the conclusion that the Kymry came from the Danish peninsula. Münch, for example, l. c., says, 'Der Name Cimbern oder Cimren für die ältere Hauptbevölkerung der jutischen Halbinsel bezeichnet diese *hinlänglich* als kymrisch;' and Prichard, whose other arguments do seem to me to deserve the epithet '*hinlänglich*,' adds to them, l. c. p. 104, 'the name of Cimbri, corresponding and nearly identical with that of the Cymru or Cumri of Britain.' This latter name he, further on, p. 168, says on the authority of Adelung, 'Mithridates,' ii. 157, is not altogether forgotten by the present Bretons. Professor Rhys, however, informs me that 'the words "Cimbri" and "Kymry" are not related at all; if "Kymry" were translated into Caesar's time, it would assume the form "Combroges," to be analysed like "Allobroges," and meaning probably Compatriots. The word is unknown to the Bretons, nor can it be traced on the other side of the Bristol Channel: so I am inclined to think it was only adopted by the Welsh as their national name while under English pressure. I do not mean by this to offer any opinion whatever on the question whether the people called "Cimbri" were nearly related to the ancestors of the Welsh or not.'

At the meeting of the British Association already referred to, thinking it might be of some consequence towards settling the much-vexed question of the Germanic or Celtic origin of the Cimbri as known to us from the time of Marius, I gave references in parallel columns to the various more or less nearly contemporary writers who had spoken of them as Germans or Celts respectively. These references I may reproduce here.

For the Celtic origin of the Cimbri, see

Cicero, De Oratore, ii. 266.
Sallust, Jugurtha, 114.
Florus, iii. 3.
Appian, De Bell. Ill. 4.
„ Bell. Civ. i. 29.
„ „ iv. 2.
Diodorus, v. 3. 2.
„ xiv. 114.

For the German origin of the Cimbri, see

Horace, Epod. xvi. 7.
Inscript. Ancyran. Tab. v. 16.
Strabo, vii. i. 3.
Caesar, De Bell. Gall. i. 40.
Velleius Paterculus, ii. 12.
„ ii. 19.
Tacitus, Germania, 37.
„ Hist. iv. 73.

probably have been of the same stock as the Cimbri whom we know from history.

This division in this nomenclature is proposed entirely independently of any consideration drawn either from philology or, to borrow a phrase from the Triads, from the 'hazy ocean' which they and similar documentary traditions make up. As regards philological considerations, I apprehend that it may cost some trouble to reconcile the fact that very many of the long skulls found in the round barrows of the bronze age lying peacefully in company with brachycephali are indistinguishable from very many of the long skulls found in long barrows together with implements of bone and stone (see p. 527 of 'British Barrows'), with the conclusion drawn from the Celtic and other words signifying metal to the effect that all the Celts were in possession of metal from the first time when they came into Europe, unless we agree to speak and think of the Stone Age as Precelтic. In other words, it is of importance to keep in mind that a division of skulls into skulls of a Silurian and skulls of a Cimbric type is, probably, not coincident with that division of the Celtic race into Gaels and Cymry which is, I suppose, the division usually adopted by historians and literary antiquarians. The race which used stone and bone implements may, so far as the naturalist's investigations teach him, have spoken either a Turanian or an Aryan tongue; what he sees in their skulls and their surroundings impresses him with the notion of an antiquity which may have given time enough and to spare for the more or less complete disappearance of more than one unwritten language. The

Plutarch, Camillus, 15.
Dio Cassius, xliv. 4. 2.
Justin, xxiv. 8.
Orosius, v. 16.
Livy, Epitom. 77.
Plutarch, Marius, 11.
,, Crassus, 9.
Pliny, iv. 28.
Mela, iii. 3.
Justin, 37. 4.
Seneca ad Helv. 6.

Most of the modern German writers on this subject, with the distinguished exception of Niebuhr ('Kleinere Schriften,' p. 383), claim the Cimbri as their kinsfolk. It may be sufficient to name Zeuss, D'Ukert, Grimm, Duncker ('Orig. Germ.' 79-92), and Dahlmann, and a monograph containing many references and other valuable matter by Dr. Pallmann, 'Die Cimbern und Teutonen,' Berlin, 1870. Baron de Belloguet agrees with these writers; see 'Ethnogén. Gaul.' iv. p. 87, 1873. For the Celtic origin of Cimbri we have, with Niebuhr, among English writers Prichard and Latham, among French writers Thierry, H. Martin ('Sur l'Ethnogénie Gauloise,' iv. p. 89, 1873), and amongst Northern writers Münch and Nilsson. The craniographer will incline to the Celtic hypothesis.

bronze period again, though its term of duration in these islands was no doubt almost infinitely shorter than that of the stone and bone age, or rather ages, was yet long enough, as the antiquary may assure the philologist, to admit of quite as great a differentiation in any single language as that which exists between Gaelic and Cymric at present, or to allow of the importation of more than one already differentiated dialect in more than one not recorded invasion. But if the bronze age may have been of very long duration, and if the stone and bone age as represented to us in the long barrows may have been of very much longer, the antiquary who may have explored one of these latter tumuli on a hill, the sides and bottom of which may contain in their gravels the implements, if not the bones, of still earlier races, knows and feels that in dealing even with human phylogeny, he has to keep constantly in mind in all his speculations that the permutations and combinations of races possible in such lengths of time are conceivably and even practically infinite. The consideration of distance in space, when we are dealing with a question of geographical distribution, is inseparably connected with the consideration of length of time, and the great interval of space which separates Spain from Great Britain should make us careful as to borrowing a name from the tribes of one of those countries, and imposing it upon a tribe in another, without the most definite historical or archaeological reasons. Without going into the arguments which the Rev. Wentworth Webster has (see 'Journal Anth. Inst. London,' v. p. 5, July, 1875) brought forward against the view which would identify the Basques with the earlier dark-haired dolichocephali of Great Britain, it may be well to state the history of the opinion which connects certain Welsh and Irish inhabitants of Wales and Ireland with the Iberian inhabitants of Spain. This, so far as I have been able to make it out, is as follows. Tacitus, in the eleventh chapter of his Agricola, says with reference to the Silures that their 'colorati vultus' and 'torti crines,' 'et posita contra Hispania, Hiberos veteres trajecisse easque sedes habitasse fidem faciunt.' The boldness of this suggestion contrasts strongly with the caution of the opening sentence of the same chapter 'Ceterum Britanniarum qui mortales initio coluerint indigenae an advecti, ut inter barbaros, parum compertum;' nevertheless, Jornandes, as quoted p. 226, and Irish and Spanish histories and traditions are constantly (see, e. g., Professor

Morley, 'English Writers,' 1867, vol. i. pt. i. p. 159) referred to as agreeing in asserting that the Irish Gael came from Spain; and it is even added, as if the process had been actually observed in the Bay of Biscay, that 'by means of their small ships, slowly and in the course of years, the Spanish Gaels colonised Ireland and our western coasts.' It seems obvious enough that what is thus put forward as a consensus of evidence means merely that a number of inferior writers repeated, as is so often the case, with particular emphasis and increase of precision one of the very few rash suggestions which a really great writer may have made[1].

The duality of type presented to us by the intermingling of dolichocephali and brachycephali in the interments of the bronze period has been continued down to the present day amongst the inhabitants of Wales and some other Celtic localities in forms which, however real, are yet happily compatible with their occupying the same area both in life and after death. The present Bishop of St. David's, in his book, 'Vestiges of the Gael in Gwynedd,' 1851, pp. 72, 73, whilst accepting the usual philological and physiological arguments against the singleness of origin for the entire British population of Wales, adds certain evidence, based upon the differing moral phenomena manifested at the present day by the inhabitants of the Principality in the form of mutual repulsion and dislike, which points in the same direction. For this the reader may be referred to his book. A similar history is given by Professor Broca

[1] Prichard, 'Phys. Hist.' iii. 108, who speaks of Tacitus as having been 'under the mistake of supposing Spain to be opposite to South Wales,' and of 'undue stress' having been laid by various writers, including Niebuhr, upon 'the idea of attributing an Iberian origin to the Silures,' seems to think that it was not his 'deliberate opinion that the Silures came from Spain.' A good deal depends upon the reading of the over-terse phraseology of the historian; I incline to think that by the words 'proximi Gallis et similes sunt' Tacitus meant to indicate that a third division of the inhabitants of Great Britain, in opposition to the Caledonians and the Silures, was constituted by those inhabiting the south-east corner of the island, next to Gaul, of whom Julius Caesar had spoken in a parallel passage, B. G. 5. 14. If this be the true meaning of those five words, the words which Prichard refers to as qualifying the suggestion as to the Silures, 'in universum tamen aestimanti Gallos vicinam insulam occupasse credibile est,' would not really have any relation to them. Zeuss, 'Die Deutschen,' p. 202, is as distinctly condemnatory of his suggestion as is Prichard: 'Mit eben so ungenügenden Gründen wie die Völker von Caledonien von Germanien werden diese Silures von Tacitus von den Iberern abgeleitet.' As regards the Irish tradition of a connexion between Ireland and Spain, Professor Rhys writes to me to the effect that it is not a genuine tradition at all but only an etymological one, all turning on (H)iberus and Hibernus or Gallicia and Gael.

of the inhabitants of 'le pays de Léon' and 'le pays de Cornouaille' in Brittany ('Mémoires de la Société d'Anthropologie de Paris,' tom. i. 1860, p. 21), and readers of other French writers on Ethnology are abundantly familiar with the question of 'la dualité gauloise[1].'

Against calling the brachycephalic people of the round barrow and bronze period by the name of the Ligures, a people so much and, probably, so unjustly abused by the ancient Latin writers, arguments of the same general kind as those already brought against calling the dolichocephali of the stone age Iberians might be adduced at considerable length. It is however superfluous to do this, as the brachycephali for whom the name 'Ligurian' has been proposed of late by the Baron de Belloguet[2], Herr Hölder[3], M. Léon Vanderkindere[4], and Professor S. Nicollucci[5], are short of

[1] It may be well to supply evidence from times intermediate in date between the present and the bronze age to show that, whatever proneness the Celtic race and its subdivisions may, as testified to by the two authors just cited, manifest to quarrels and disagreements of a minor kind, they have in practice found it more possible to make such differences compatible with joint occupation of the same country than have some other races. Diodorus Siculus, v. 33, cit. Zeuss, p. 163, writes thus of the formation of the Celtiberian nation: Οὗτοι γὰρ τὸ παλαιὸν περὶ τῆς χώρας ἀλλήλοις διαπολεμήσαντες, οἵ τε Ἴβηρες καὶ οἱ Κελτοί, καὶ μετὰ ταῦτα διαλυθέντες καὶ τὴν χώραν κοινῇ κατοικήσαντες, ἔτι δὲ ἐπιγαμίας πρὸς ἀλλήλους συνθέμενοι, διὰ τὴν ἐπιμιξίαν ταύτης ἔτυχον τῆς προσηγορίας. Δυοῖν δ' ἐθνῶν ἀλκίμων μιχθέντων, κ.τ.λ.

The words of Skylax, cit. Zeuss, p. 167, respecting the Ligurians and Iberians are similarly to the purpose: Ἀπὸ δὲ Ἰβήρων ἔχονται Λίγυες καὶ Ἴβηρες μιγάδες, μέχρι ποταμοῦ Ῥοδανοῦ.

The existence, lastly, of the name Κελτολίγυες, Strabo, 4. p. 203, may seem to show that a fusion was effected between the Celts and the Ligurians similar to that which was effected between the Celts and the Iberians. The earlier relations between the Celts and the Ligures are represented in tradition to the following effect in the lines of Avienus, 'Ora Maritima,' v. 432 :—

> 'Cespitem Ligurum subit
> Cassum incolarum, namque Celtarum manu
> Crebrisque dudum proeliis vacuata sunt
> Liguresque pulsi.'

[2] 'Ethnogénie Gauloise,' cit. Virchow, 'Archiv für Anthropologie,' vi. p. 107, 1873.

[3] 'Archiv für Anthropologie,' ii. p. 56, 1867. In his 'Zusammenstellung der in Würtemberg vorkommenden Schädelformen,' 1876, p. 8, Herr Hölder has given up the title 'Ligurian,' and replaced it by the titles 'Turanian' and 'Sarmatian.'

[4] 'Recherches sur l'Ethnologie de la Belgique,' p. 58. The skulls, with a cephalic index of 85, described by Dr. Sasse from South Beveland, 'Archiv für Anthropologie,' vi. p. 76, had a cubical content of 1323 cub. centim. = about 80 cubic inches, as against an average content of 98 cubic inches obtained by Dr. Thurnam from twenty-five British brachycephali. Probably this inferiority was correlated with an additional inferiority in the matter of stature.

[5] 'La stirpe ligure in Italia,' Napoli, 1864.

stature and dark of complexion, whereas the brachycephali with whom we have to deal were certainly tall, and all but equally certainly light in hair and complexion.

The skulls from the earlier British barrows have been stated to be invariably dolichocephalic, whilst the skulls from the barrows of the bronze period, though in some cases exclusively brachycephalic, may belong to either one or other of these two types. The few skulls which I have been able to examine or to read of from interments of what is called the late Celtic period, the period intervening between the close of the bronze age and the establishment of the Roman power in this country, have been dolichocephalic, a fact which may be explained either by a reference to the well-known persistence with which 'les types autochthones survivent à la domination étrangère et au mélange des sangs[1],' or, though with less probability, by the hypothesis of a preponderance having been given in this iron age to the still surviving dolichocephalic stock in the way of invasions from the continent. The dolichocephalic late Celt however differed probably from the dolichocephalic inhabitant of these islands in the stone age in being light- instead of dark-haired[2]. See pp. 255, 283 infra.

It is undoubtedly an important fact that in no skull from any long barrow, that is to say, in no skull undoubtedly of the stone age, examined by us, has the breadth been found to bear so high a relation as that of 80 : 100 of the length ; for this alone would suffice to show that Retzius's classification of skulls into two great divisions of dolichocephalic and brachycephalic cannot, even when taken to connote merely the strictest geometrical proportions, be summarily set aside as an artificial one. But, as Professor Cleland has well pointed out in a memoir ('Philosophical Transactions,' 1870, vol. 150,

[1] Broca, 'Mémoires,' i. 340, 341.

[2] Broca, 'Bull. Soc. Anth. Paris,' sér. ii. tom. viii. Avril, 1873, p. 319, says that certain districts of modern Brittany, in which the British refugees from the Saxon invasion of the fifth century settled in great numbers, are still distinguished by the tallness, light complexion, and dolichocephaly of their inhabitants. He calls this stock 'Kymrique,' in the application of which word I differ from him. Similarly, at least as to the cephalic index, certain interments from the period of transition from bronze to iron described by Kopernicki, cit. Ecker, 'Archiv für Anthropologie,' ix. p. 118, 1876, as examined by him in South-east Galicia, were found to furnish skulls 'exquisite orthognathe dolicho-cephalen' (C. I. = 73), contrasting strongly with the pronounced brachycephalism (C. I. = 81) of the modern Ruthenian inhabitants of that district.

p. 145), the value of which is in the inverse ratio of the attention it has received, at least from foreigners, by 'dolichocephaly' and 'brachycephaly' respectively, Retzius intended that much more should be connoted than that 'ordinarily the longitudinal diameter of the dolichocephalous skull surpasses the breadth about one fourth, while in the brachycephalous the difference varies between a fifth and an eighth[1].' I propose here to enumerate the various points, mostly, though not entirely, those specified by Retzius, which characterise the two sets of dolichocephalic and brachycephalic crania with which I have here to deal, besides and beyond those which are etymologically implied by these names; and having done this I shall attempt to give some rationale of the existence of these differences.

The peculiarities of the contour of the brachycephalic crania already described have been repeatedly alluded to above, pp. 175–202; of these peculiarities the most important as well as the most constant is, I incline to hold, the relation held by the posterior aspect of the skull to the plane of the parietal tubera. In the brachycephalic skull the parietal tubera are usually situated high up on the sides of the skull, and almost invariably the profile line of the vertical arch as viewed in the norma lateralis dips into the posterior aspect of the skull at a point very little behind the plane of these tubera. The skull, in other words, and from another point of viewing it, that namely of the norma verticalis, rounds itself off somewhat abruptly from the level of the parietal bosses, instead of tapering as in the other type somewhat gradually

[1] Retzius confined himself to this binary division of skulls, and I have in the foregoing 'Description of Skulls' followed his example in this matter. Other writers have made many subdivisions of the two primary divisions of Retzius, which may be seen given in a tabular form by Ihering, 'Zeitschrift für Ethnologie,' bd. v. 1873, p. 12. The subdivision suggested by Ihering himself, p. 141, has claims upon the attention of those who wish for additional subdivisions constituted upon the principle of actually existing proportions. He proposes to call

Skulls with a relation of breadth to length of 80 and upwards, 'Brachycephalous.'
" " " 72 and below, 'Dolichocephalous.'
" " " 72–80, 'Mesocephalous.'

And of 'Mesocephalous,' those with index from 72–76, 'Mesodolichocephalous.'
" " " 76–80, 'Mesobrachycephalous.'

A far more important subdivision has been suggested by Professor Cleland, l. c. p. 148, whereby each of the two primary divisions would be subdivided according as they are 'latiores' or 'angustiores,' whilst retaining the contour characteristic of their respective types.

towards the squama occipitis. This latter portion of the posterior aspect of the skull is not, as usually stated, by any means invariably flat; it is, on the other hand, very frequently markedly convex, the more markedly so, of course, on account of the flattening of the parietals to form the dip into the back aspect of the skull. As above pointed out in the description of the skull 'Cowlam' (lix. 3, p. 226), p. 189, note, the occipital squama may so project as to constitute what has been called a 'capsuläres Hinterhaupt' in typically brachycephalic crania. In casts of such skulls the parts of the brain which were lodged in the fossae of the superior squama occipitis may be seen to project as well-defined mammillary out-growths beyond the plane of the curve of the upper part of the posterior aspect of the cerebral lobes, and to overlap the cerebellum proportionately[1]. Now it was shown long ago by Huschke (in his 'Schädel, Hirn und Seele,' 1854, p. 142), and has been repeatedly confirmed since by other investigators of the relations of the brain to the brain-case, that the parietal eminence covers a particular lobule in the brain beneath it, the lobule, to wit, which is called by Gratiolet in his better known[2] 'Mémoire sur les Plis Cérébraux,' p. 60, the 'lobule of the marginal convolution;' and which is called by Huschke, l. c., the 'lobulus tuberis.' Similarly Huschke (pp. 62 and 142) pointed out that a particular part of the brain was limited in front by a line corresponding to the upper part of the lambdoid suture, and, similarly, subsequent writers have coincided with his observations. There is of course no greater *a priori* improbability

[1] See p. 177, note, supra, and compare figure of skull from Wetton Hill Barrow, 'Cran. Brit.' xiv. pl. 12, and pl. 16 and 27: and in 'Crania Helvetica,' E. xvi. and xvii.

[2] Huschke, owing to certain faults of style and arrangement, and also to his investigations of facts being very largely interlarded with questionable philosophy, has not obtained all the credit which his laboriousness merited. Besides allocating the lobulus tuberis, and the occipital lobes proper, to particular parts of the skull, he also defined the true position of the fissure of Rolando relatively to the coronal suture, p. 139, and that of the superior frontal gyrus relatively to the frontal tubera, p. 154, in the some year in which Gratiolet, l. c. p. 101, wrote as follows: 'La boîte crânienne forme une vaste et libre cavité. C'est une voûte sous laquelle les plis et lobes cérébraux s'avancent, se reculent, s'étalent, se resserrent, s'écartent, se refoulent; ces mouvements n'ayant aucune relation absolue avec les éléments dont cette voûte se compose!'

Huschke's own countrymen, to whom his writings must be easier reading than they are to readers of other nationalities, have not always rendered him full justice. Professor Meynert however forms an exception to this rule; see his paper on Die Windungen der convexen Oberflache des Vorderhirns, 'Archiv für Psychiatrie,' bd. vii. hft. 2.

attaching to the view, that as fixed a relation should subsist between particular parts of the cerebral hemispheres and the bony capsule thrown over them as every one knows to subsist between the various factors of the dental series and the maxillary and intermaxillary bones respectively of a marsupial or a placental mammal. The fact however, when demonstrated, gives a fresh interest to cranioscopy, and I shall revert to it further on, p. 265 et seqq. infra.

The conceptacula cerebelli in the brachycephalic type are said by some authorities[1] to take a more vertical direction than they have in the dolichocephalic; and they are also supposed to be more[2] globose externally in female than in male skulls. An examination of the strong male skulls of the bronze period bears out neither of these views. It is true that such skulls may have the lower part of the occipital bone flat and semivertical, but they often have the convexity downwards of the inferior squama occipitis as marked as we sometimes see it to be in skulls of feebler texture in which it might be considered to be a 'déformation plastique[3],' and to be due to downward pressure of the superincumbent brain. And this convexity of the conceptacula cerebelli, when viewed in the light which Professor Cleland (l. c. pp. 136, 162) has thrown upon the extent to which 'gravitation changes' can remodel the cranium after adult-life has been reached, may very reasonably be considered to be due, in some measure at least, even in this robust type, to the operation of the same downward pressure. Be this as it may, the convexity of the inferior occipital squama of the British brachycephali, a peculiarity which would not have been visible to the eye during life, is, if not correlated with, at any rate accompanied very often (see p. 201 supra) by another peculiarity, which must have been eminently striking in their living heads, to wit, their great relative height, which has been called 'hypselocephaly,' or 'acrocephaly,' and must have put them into sharp contrast with the 'tapeinocephalic[4]' or 'low-lying' heads of at

[1] Cleland, 'Phil. Trans.' 1870, p. 147. Thurnam, 'Principal Forms,' p. 37.

[2] Welcker, citing J. B. Davis, 'A. A.' i. 126, 1866, per contra Huschke, l. c. p. 21, says:—'Die *fossae cerebelli* der Hinterhauptsschuppe beim Manne weit ausgegrabener sind und daher äusserlich mehr hervorragen als die weiblichen welche, wie im Kinde, mehr horizontal liegen.'

[3] The true 'déformation plastique' of Dr. B. Davis I have never seen in these series.

[4] For the use of this word see Professor Busk, 'Journ. Ethn. Soc. Lond.' vol. ii.

least the female descendants of the long-barrow people who were still living amongst them. It puts the skulls into a similar position of contrast when compared with most of those of the dark-haired brachycephalic stocks now existing in Europe; and, taken together with their much larger cubical capacity, with the greater stature, and with the different complexion of their owners, it shows us that we have to deal, if not with two exceedingly different races of men, at least with two exceedingly different sets of individual men[1]. But we must never lose sight of the fact that in dealing with a series of skulls from these prehistoric barrows we are all but certainly dealing with the skulls of a set of individuals from the upper classes of times when members of those classes were, as are the chiefs of many modern savage races, from the operation of one or both of two causes, larger and more powerful, and *pro tanto*[2] larger-brained men than were the mass of the population.

pp. 467, 468, where it is suggested that tapeinocephaly may indicate lowness of type among ancient as it does among the modern Bushmen and Tasmanian races.

[1] The average cubical capacity of the ancient British brachycephali, as given by Dr. Thurnam, is 98 cub. in., as against 94 cub. in. for modern English skulls; as against 80 cub. in. (=1323 cub. cent.) obtained by Dr. A. Sasse for a series of probably comparatively recent brachycephalic skulls, with an index of ·85, from South Beveland, 'Archiv für Anth.' vi. p. 76, 1873; as against an average of about 90 cub. in. (=1480 cub. cent.) for the modern Parisian skull, with an index of about ·79; as against an average of 83 cub. in. (=1377 cub. cent.) for the Disentis type of His and Rütimeyer, with an index of ·86, which includes most of the modern inhabitants of Switzerland, together with some skulls of Roman, if not of earlier times; as against an average of 89 cub. inc. (=1478 cub. cent.) for the modern Roumanians, with an index of ·82; as against an average of 92 cub. in. (=1521 cub. cent.) for the modern German (Weisbach); and as against an average of 80 cub. in. for modern Red Indians. Herr Hölder, in his earlier paper, 'Arch. für Anth.' ii. p. 55, 1867, gave for his 'Ligurian' type, with a cephalic index of from ·84 to ·90, a cubic capacity varying from 79 cub. in. (=1300 cub. cent.) to 97 cub. in. (=1600 cub. cent.). In his monograph published last year the two types 'Turanian' and 'Sarmatian,' into which the single form 'Ligurian' is divided, are both said to have their height less than their breadth.

[2] One of these causes was no doubt their possession of a greater command of the material comforts of life; the other was the necessity which a wild tribe under a severe struggle for existence had for putting itself under the guidance of the ablest men it could find. A statement as to the operation of the first of these *verae causae* is given us by Bastian, 'Ethnologische Forschungen,' i. 335, on the authority of Logan as to Scotland, to the following effect: 'The common Highlanders from hard and often scanty fare are usually inferior in stature to the chiefs and better sort.' A statement as to the operation of the second as to Africa is given us by Mr. F. Galton in his 'Hereditary Genius,' p. 339, 1869, in the following words: 'A native chief has as good an education in the art of ruling men as can be desired; he is continually exercised in personal government, and usually maintains his place by the ascendancy

In dealing with a series of modern skulls we are not so dealing with the skulls of the upper classes only; but ordinarily just the reverse.

This source of fallacy however does not vitiate the comparison to be instituted between the tenants of the long barrows and the more recent but still prehistoric tenants of the round ones. Indeed, as regards the point of social superiority, the larger cubical bulk of many of the long barrows relatively to the number of skeletons contained in them would seem to indicate that the owners of these skeletons had been during life, and indeed after it, in a position to command more of the labour of their fellow-men than the men of the bronze period. And there is no doubt that some of the earlier, or indeed, as the Les Eyzies skull, with a cubic capacity of 100″, reminds us, earliest skulls can compare favourably with the very largest of the bronze or indeed of any other age. Dr. Thurnam's measurements gave him an average of 98 cub. in. for the British brachycephali as against 99 cub. in. for the older race; and the largest prehistoric skull which I have been able to cube was a woman's from the stone-age excavations at Cissbury; see 'Journal of Anthrop. Institute,' vol. vi. p. 35, 1876. Nevertheless, with my unhappy knowledge of the very large number of skulls from all prehistoric tumuli which are not recovered in a condition admitting of cubage, and for other reasons to be gathered from what has been said above, I feel that the result of the application of the method of averages to the question of the relative cranial capacity of the two prehistoric races under comparison is eminently unsatisfactory, as being eminently amenable to the question, 'Ubi sunt illi qui perierint?' And I must express it as my distinct conviction, that if we could have before us a more fairly representative series of each of the two varieties of prehistoric crania in question than their social habits and the wear and waste of many centuries of lying in stony graves have left

of his character shown every day over his subjects and rivals.' Professor Daniel Wilson says ('Canadian Journal,' March, 1863, p. 151): 'I assume the unimpaired intellect of the Nasqually chief from his rank.' For further evidence as to one or other of these lines of action see the Göttingen Report of 'Zusammenkunft einiger Anthropologen' in 1861, at p. 21; in the 'British Association Report for 1875,' p. 150; Förster's 'Observations,' pp. 229, 410; Ellis, 'Polynesian Researches,' i. 82, ii. 26; 'Tour through Hawaii,' p. 7; Erskine's 'West Pacific,' pp. 155, 240; Brenchley, 'Cruise of the Curaçoa,' 1873, p. 137; Whitmee, 'Contemporary Review,' Feb. 1873, p. 392; 'Journal Anthr. Institute,' vol. v. p. 127, Oct. 1875; H. N. Moseley, ibid. p. 36, May 1877.

us, we should find that the bronze brachycephali had been not only the taller and stronger bodied, but also the larger skulled [1] and larger brained race of the two. The well-filled character of the typical brachycephalic skull is nowhere and no way better shown in a single view of it than in the norma occipitalis, where in spite of the well-developed tubera parietalia it is rare for any very marked convergence of the lateral walls of the pentagon to be observable.

The forehead of a brachycephalous skull is sometimes vertical, sometimes, and especially in cases where the whole skull and skeleton are marked by great strength or even ruggedness, it is markedly sloping. It has been well remarked by Professor Cleland, l. c. pp. 163 and 138, that it is 'a grave mistake to predicate deficient development of the anterior lobes of the brain from a retreating forehead or great development from a vertical forehead without reference to the rest of the form of the head.' And in a preceding page (p. 160) he has pointed out that to secure the balancing of the head on the vertebral column, when the anterior lobes of the brain and the bones of the face increase in weight, without any unnecessary or constant call upon muscular force, a certain amount of 'tilting or rotation backwards' is mechanically necessary, and is physiologically effected. Another explanation has been given [2] of the sloping of the forehead by supposing it to be caused by increase in length of the basicranial axis, and a consequent throwing forward of the lower half of the frontal bone; and, as Professor Cleland has himself pointed out, l. c. p. 124, a long base line is eminently characteristic of the skulls of uncivilised nations. But though the operation of this cause may

[1] For the purposes of a comparison made upon such a basis it would be safe to take the largeness of the skull as furnishing a measure of the largeness of the brain it contained. The thickness of the skull-walls to be estimated by weighing the skull or, by preference here, the calvaria, would probably not differ very much, and, if at all, to the disadvantage, I incline to think, of the brachycephalic type. Allowance would of course have to be made for any difference set up either by the removal of organic matter or by the infiltration and deposit of inorganic salts of iron or of lime. It may be true, as Professor Bischoff has shown, l. c. pp. 36, 45, that extraordinary individual variations in the brain-weight may be noted in brains from skulls with the same circumference, and that no fixed relation can be affirmed to exist between the variations of brain-weight and those of cubical contents as measured by other than brain-substance; but this want of concomitance would be as likely to occur in the one as in the other set of subjects of comparison.

[2] Welcker, 'Wachsthum und Bau,' p. 76.

account for the retreat of the forehead in the heads of some dolichocephalic races, as also for the readily observable fact that in male skulls even of civilised races a sloping forehead is much more common than in female skulls, in which (see Cleland, p. 125, l. c.) the growth of the base line ceases much earlier, I do not think that it accounts for the obliquity so often observable among the British brachycephali. In them I incline to consider it as the result of counterpoise to their heavy lower jaws[1]. Many

[1] It is interesting to reproduce here some remarks on this subject made nearly forty years ago by a French writer, M. Lafargue, in a journal the early volumes of which I have had some difficulty in getting access to, and procured ultimately from the library of the Royal College of Physicians. They run as follows ('Archives Générales de Médecine,' iii. 2, 1838, p. 135): 'Etant données des mâchoires volumineuses et saillantes, la totalité du crâne se porte spécialement en arrière, en se distribuant avec uniformité autour de l'axe s'il est allongé comme chez le nègre, en se concentrant à l'extrémité postérieure de cet axe s'il est raccourci comme chez le Calmouk et le Malais.'

P. 137. 'Les crânes des différentes races humaines trouvent comme on voit la raison de leurs formes dans les proportions respectives de la face et du cerveau et dans certaines conditions d'équilibre qui varient avec ces proportions.'

The following remarks deserve attention for their bearing upon some wider questions, as well as upon the particular one referred to in the two preceding ones.

P. 141. 'Il résulte de ce qui procède que la forme du crâne des différentes variétés humaines a deux significations réelles: l'une se rapporte à certaines conditions d'équilibre, variables suivant la proportion de la face au cerveau; l'autre exprime le degré de perfection intellectuelle et morale, en indiquant le volume de ce dernier organe. Mais la cérébroscopie comparée ne justifie pas les trois grandes localisations phrénologiques.

'Si l'on compare entre eux les sujets de la même race, on trouve un grand nombre de faits exceptionnels qu'il est nécessaire d'apprécier, avant d'examiner le système de Gall dans son application aux individus de la race blanche.

'L'intelligence et le moral sont d'autant plus complets que le cerveau l'emporte davantage sur la face: telle est la loi qui résulte de la comparaison des espèces animales aux races humaines, la loi dont Camper, Daubentin et Cuvier ont reconnu la réalité. Quelques hommes plus logiciens qu'observateurs pensent que le volume *absolu* de l'encéphale détermine seul la puissance intellectuelle; que deux individus dont les hémisphères sont égaux doivent manifester la même capacité, bien que l'un d'eux l'importe sur l'autre par le volume des mâchoires: car, ajoutent-ils, ce volume n'a aucun rapport avec les fonctions de l'encéphale. Les raisonnements *a priori* se brisent contre les faits, et le rapport direct des facultés avec la masse, non pas *absolue*, mais *relative* des hémisphères est un *fait* d'histoire naturelle, un fait assez constant pour établir une loi.

'Cette loi, franchement exprimée par les caractères généraux de chaque type, ressort encore de la comparaison des individus de la même race; ainsi, dans la variété blanche, il est bien reconnu que les hommes supérieurs ont le plus souvent un crâne bien développé et des mâchoires peu saillantes; qu'au contraire, le plus grand nombre des hommes *simples*, *obtus* ou *idiots* se distinguent par l'étroitesse de la cavité cérébrale, et par la proéminence de la face, signe proverbial de stupidité.

'L'angle facial, expression de cette proéminence, a de tous le temps fixé l'attention

of the bronze-period skulls with sloping foreheads are yet skulls of large capacity, and we have no reason for doubting that their owners may have been, as men with such foreheads often are now, persons at once of considerable intellectual and of considerable physical power. It is not easy to understand why in some cases we should find brachycephalic skulls with fairly powerful lower jaws maintaining nevertheless the same or nearly the same verticality of forehead which characterised them in childhood and early boyhood. It is obvious however that in cases such as these[1], the length of the base line of the skull remaining as it does practically the same, or differing by merely the tenth of an inch or so, and the length of the frontal, parietal, and occipital arcs, which make up the cranial vault resting on this base line, remaining also practically constant, the position of the true vertical line of the cranium must, as already mentioned (p. 163, note), change its position relatively to the coronal suture. And with this change there must have followed during life a somewhat different mode of carriage of the head relatively to the horizon, a difference observable enough in living heads at the present day.

As regards the characteristics of the facial skeleton, I find my observations upon the brachycephali of the East Riding of Yorkshire in entire accordance with those given picturesquely as well as scientifically of the facial characters of the brachycephali of the South-west of England by Dr. Thurnam in his papers in the Memoirs of the London Anthropological Society, vols. i and iii, 1865–1869. Distinctive as must have been the characteristics already pointed out of the living calvaria and its hairy scalp, the characteristics of the living face, from the supraciliary ridges to the chin and transversely from one cheek

des sculpteurs et des physionomistes. Telle est la règle: voyons les exceptions. Si beaucoup d'hommes éminents, comme Gall, Cuvier, Bacon, se distinguent par un cerveau très développé, un large front, une face petite et verticale, quelques autres, comme Mirabeau, Buffon, ont le crâne étroit, le front fuyant, et les mâchoires très prononcées. Au contraire, on voit assez souvent des individus remarquables par le développement du crâne, par les proportions harmoniques et la beauté de la face, manifester néanmoins une déplorable incapacité. Leurs traits immobiles ou niaisement expressifs, leurs yeux mornes ou pétillants d'une joviale nullité, concourent à démentir la noblesse du front. Peut-on attribuer l'infériorité de ces hommes au vice de l'éducation, si celle-ci a été la même pour eux que pour les autres?'

[1] See Aeby, 'Schädelformen,' p. 127.

bone to the other, must have put the men of the round-barrow time into even sharper contrast with the surviving descendants of the men of the stone and bone ages. The eyebrows in the powerful men of the later period, if developed at all in correspondence with the large underlying frontal sinuses and supra-orbital ridges, must have given a beetling and probably even forbidding appearance to the upper part of the face, whilst the boldly outstanding and heavy cheek bones must have produced an impression of raw and rough strength and ponderosity entirely in keeping with it. Overhung at its root, the nose must have projected boldly forwards, not merely beyond the plane of the forehead, but much beyond that of the prominent eyebrows themselves. In some cases, but not by any means in so many as might *a priori* have been expected, the somewhat lengthy upper jaw had its anterior or incisive segment projecting so as to constitute alveolar prognathism, whilst the sockets of the canines and those teeth themselves attained such a development as to give a somewhat square appearance to the jaw when viewed from in front. The lower jaw, which in every well-marked variety of the human species contributes very importantly towards the making up of its distinctive character, was in the brachycephalous Briton usually a very different bone from the lower jaw of his Silurian predecessor. Its chin was prominent, and contributed a greater proportion to the entire depth of the bone in front than the alveolar portion. Its ramus might not be thicker and stouter than the ramus of the other variety with which it is compared, but as the eye follows the lower line of two such lower jaws along to their angle the superior strength of the later type is made manifest, not merely by the muscular markings and eversion of the angle, but by the much greater width of the entire bone at this point.

We may now pass from the brachycephalic British skull of the bronze period, leaving some of its minor characteristics to be gathered in the way of contrast from the ensuing general description of the dolichocephalic variety, and summing up the general impression which an inspection of a series of such skulls makes upon an observer by saying that it suggests the application of such epithets as 'well-filled,' 'eurycephalic,' 'sub-cubical;' or when the rounding-off effect of senile change has begun to tell, 'subsphe-

roidal;' and finally of 'massive and powerful' in an eminently emphatic manner.

When a considerable number of skulls from any one barrow of the stone and bone period, such as those spoken of at pp. 539–541 of 'British Barrows,' are arranged in a single line upon a long table along another line of the surface of which a corresponding number of the brachycephalic crania of the bronze period, and along a third a corresponding number of Anglo-Saxon crania are similarly arranged, the following remarks suggest themselves to the craniographer. It might be said, firstly, that the two sets of pre-Saxon skulls were well nigh as distinct and as sharply contrasted as any other sets of skulls which it is possible to put alongside of each other from either ancient or modern times; that the Tasmanian skull could scarcely be said to differ more from the modern European, nor the Eskimo from the Andamanese, than some of the typically elongated and wall-sided long-barrow skulls differ from the broad and sub-spheroidal skulls of the bronze period. And (whatever may have been averred to the contrary) it might be said, secondly, that though the Saxon series agreed with the long-barrow series in being dolichocephalic, and though in a few instances skulls from these two series were very closely like each other, there was nevertheless no great difficulty in distinguishing between these two series also, and even that in the individual cases of similarity it was very rare not to be able to point out, when all the peculiarities of each skull were taken into account, some one or more than one important point of difference either in the calvariae, or in the facial bones, or in the lower jaws of the older and of the more recent skull[1].

[1] Many authorities may be cited for the proposition that the typical dolichocephalic Scandinavian is not to be distinguished from the typical dolichocephalic Celtic skull. Amongst these may be named Retzius and Sir William Wilde in Retzius' 'Ethnologische Schriften,' p. 8, cit. Huxley in 'Prehistoric Remains of Caithness,' p. 129; Nilsson, 'Ancient Inhabitants of Scandinavia,' ed. Lubbock, p. 117, and 'British Assoc. Report,' 1847, p. 32; Omalius d'Halloy, cit. Virchow, 'Archiv für Anthrop.' vi. 1873, p. 114; Virchow himself, 'Berliner Abhandlungen,' 1876, p. 3; Ecker, 'Archiv für Anthrop.' iii. 155; Schaafhausen, 'Die Urform des menschlichen Schädels,' p. 5. Against all these weighty authorities I have to set the fact that if I place a skull of one or other of these two races before the skilful and very extensively experienced articulator and restorer of prehistoric crania, Mr. W. Hine of the University Museum, without giving him any hint of the archaeological surroundings in which it was found, he will ordinarily be right in his reference of the skull to one or other of these races. The

A third remark of equal generality and importance would be suggested by this survey of these three sets of crania, to the effect that though skulls very closely similar to the typical representatives of either of the prehistoric series might be found upon living shoulders amongst the present population of this country, the elongated and fairly well-filled oval Anglo-Saxon cranium was the prevalent form amongst us in England [1] at the present day.

points of difference which thus guide to a right conclusion will appear in the description to be given in the text.

[1] In Germany anthropologists are not as yet at one as to whether the dolichocephalic form of skull, which when combined with tall stature and light hair and complexion has been usually considered to constitute 'Das Germanische Typus,' is at the present day both outnumbered and qualitatively excelled by the brachycephalic type or not. Ecker, in the 'Archiv für Anthrop.' ix. 4, p. 259, 1877, expresses himself thus: 'Wissen wir doch z. B. dass die in unserem Lande einst so verbreitete Schädelform der Reihen-Gräber die wohl unzweifelhaft auch mit einer bestimmten Körperstatur verbunden war, jetzt fast ganz einer anderen Form Platz gemacht hat, deren Träger in ihrem ganz physischen Habitus anders geartet sind, als jene es wahrscheinlich waren. Waren jene hochgewachsen vorherrschend blond, so sind diese gedrungener, dunkler von Haar und Augen.' Virchow, who has repeatedly expressed himself to the effect that brachycephaly is a higher form of skull than dolichocephaly (see 'Arch. für Anth.' v. 4, 1872, p. 536, where Calori is quoted to the same effect as regards the Italians; or, 'Zeitschrift für Ethnologie,' iv. 2, p. 36, where Cortese is similarly cited as to the smaller size and stature of modern Italian dolichocephali; or, 'Sammlung,' ix. 193. 1874, p. 45), would appear, from his saying, 'Arch. für Anth.,' l. c. p. 540, that the broadening which the dolichocephalic modern German skulls of which Herr Hölder writes have attained to as compared with the ancient dolichocephali may bring them within the limits of brachycephaly by measurement, to neglect the difference which Professor Cleland ('Phil. Trans.' l. c. p. 146) has so well insisted upon as existing between dolichocephaly of type and contour as opposed to that constituted by mere measurement of the single relation of breadth to the length, and that too irrespectively of the height. Herr Hölder appears to have proved that the Germanic type as ordinarily understood has the larger and better developed brain, at all events in the parts of Germany known to him (see his Memoirs, 'Archiv für Anthropologie,' ii. pp. 53–55, and 'Zusammenstellung der in Würtemberg vorkommenden Schädelformen,' 1876, and the discussion at the meeting of the German Association for Anthropology held in Stuttgart in August 1872, reported in the 'Arch. für Anth.' v. p. 539). His words in the Report just quoted are, 'In Würtemberg finden sich aber unter den seit Generationen geistig beschäftigten Ständen viel mehr dolichocephale Formen als unter den Handarbeitern.' The facts, so far as I can collect them as regards Germany, appear to me to be that the genuine Teutonic type, as we know it from undoubtedly Anglo-Saxon, and from Frankish skulls, has, in the course of centuries (some of which have been times of culture, and all of which may have been times admittedly of crossing with a brachycephalic stock), intermediate in archaeological date between the Reihen-Gräber period and the earliest graves, become relatively somewhat broader, but without losing its primitive contour. Throughout Germany however there exists a brachycephalic stock, usually, but by no means always, darker haired and of shorter stature and of less cranial capacity than the typically dolichocephalic variety; and

A fourth general observation would arise out of such an inspection of these three series of crania, to the effect that, though in each of them a certain number of what Professor Cleland has expressively called 'ill-filled skulls' were to be pointed out, the larger proportion was to be found in the earlier of the two series. To this subject we shall revert further on, and we may now proceed to make some more detailed remarks upon the particular characteristics of the long-barrow-period skulls.

Viewed in the norma lateralis, skulls of this kind most usually present us (see figure of 'Langton Wold, ii. 1,' p. 204) with a contour line describing a more or less even oval curve from the upper boundary of the supraciliary ridge to the centre of the prominent occipital squama. A few instances however will be found in which the upper contour line, instead of describing the curve, will, after sinking into a broad undulation posteriorly to the coronal suture, rise to its highest point in the middle third of the parietal arc before passing on to the back aspect of the skull. They thus reproduce on a small scale the peculiarities of the annularly constricted variety of artificially deformed skulls (see p. 195 supra), and, like these skulls, will be usually found to belong to individuals

this stock, whatever its other disadvantages, has at all events a numerical preponderance in South Germany (see Huschke, l. c. p. 98; Virchow, 'Beiträge,' 1876, p. 6; Huxley, in 'Prehistoric Remains of Caithness,' p. 108). Persons who will verify the references I have given will find that a good deal of other than purely scientific interest has come to attach itself to this discussion. Professor Broca's views as to the superiority of the brachycephalic type appear to coincide with Professor Virchow's. They may be found in his 'Mémoires,' vol. i. 1871, p. 342, and 'Bull. Soc. Anth. de Paris,' Tom. vii. Sér. iii. Fasc. v. Dec. 5, 1872. Dr. Hölder's last summing up of the question, 'Zusammenstellung,' pp. 34, 35, runs thus:—

'Die Bewohner des heutigen Europa sind ein buntes Gemisch der oben angeführten 4 Rassen zu 2, 3 oder 4, und nur von dem Vorherrschen der einen oder anderen dieser Elemente hängen die Eigenthümlichkeiten der verschiedenen Nationen ab. Nur in einem theile von England, Schweden und Deutschland herrscht der germanische Typus vor, ganz unvermischt ist aber wohl nirgends mehr. In dem grösseren Theile des letzteren stehen die germanischen Elemente den brachycephalen in ziemlich gleicher Zahl gegenüber, oder sind sogar in entschiedener Minderheit. . . .

'Mit der unverwüstlichen Zähigkeit welche ihm eigen ist, kommt er selbst in den am meisten brachycephalen Bezirken Deutschlands immer wieder auf die Oberfläche, wie die von mir zusammen gestellten Mischformenreihen zeigen. Welches das Endresultat sein wird, kann niemand wissen, nur so viel ist sicher, dass alle Mischrassen so lange in Fluss bleiben, bis sie zu Grunde gegangen sind oder bis das schwächere Element von dem kräftigeren umgewandelt ist; aber nur bis zu einem gewissen Grade, denn auch das stärkere erleidet Veränderungen, welche nur unter ganz ausnahmsweisen Bedingungen wieder verschwinden könnten.'

of slight build and feeble physique. They resemble even more closely in this point and some others the 'hypsistenocephali' of Dr. Barnard Davis. The one eminently distinctive and characteristic point of these dolichocephalic skulls is the forward position of the parietal tuberosities, and of the ear, with which is correlated even in female skulls (as for example 'Sherburn Wold, vii. 1,' p. 208) an oblique slope as opposed to a precipitous vertical dip in the parieto-occipital region. The temporal lines and the half of the lambdoid suture are seen laterally in nearly or quite their entire length. The forehead may be, and indeed often is, low as viewed in the norma lateralis and narrow as viewed in the norma verticalis, and may very well merit the description 'frons valde depressa' which Sir R. C. Hoare bestowed (Archaeologia, xix. p. 46) on some long-barrow skulls dug up by him; but it rarely manifests that pronounced obliquity, 'le front fuyant,' so common in brachycephalic skulls, and shown so plainly in the figure of the skull 'Rudstone, lxiii. 9,' p. 192 supra. In many, and especially in the weaker, dolichocephalic skulls the more strictly calvarial portion of the frontal bone rises from a plane considerably posterior to that of the supraciliary ridges, a peculiarity which, when the frontal rises nearly vertically to the level of its tubera, and when, as is very often the case in this variety of cranium, the supraciliary ridges are confluent across the middle line, gives a very characteristic appearance to these skulls. Just as the line of the os frontis in these cases lies some way within the line which the contour of the supraciliary ridges would describe if produced, so the line of the posterior half of the parietals lies often well within the line which the produced contour of the upper occipital squama would give us. This peculiarity is 'die facettirte Absetzung des Hinterhaupts' spoken of as eminently characteristic of the Hohberg type of skull by Professors His and Rütimeyer. It is however, though common, not by any means constant in otherwise typical dolichocephalic skulls of the stone age, as might have been expected, the occipital segments proper, both of brain and of skull, being exceedingly variable[1] in development; and the 'capsuläres Hinterhaupt,' as

[1] Aeby, 'Schädelformen,' p. 12; Welcker, 'Wachsthum und Bau,' pp. 36, 46, 65, 141; Huschke, l. c. pp. 19, 21, 94, 96, 98, 152, 153, 156; B. Davis, 'Thesaurus Cran.' p. 351; 'Gall. Syst. Nerv.' iii. 160; Virchow, 'Gesamm. Abhandl.' p. 916; Cleland, 'Phil. Trans.' 1870, p. 132; Wundt, 'Physiolog. Psychologie,' 1873, p. 229, citing H. Wagner;

pointed out above, p. 189, or as seen in such a skull as the one figured xiv. Pl. xii. 'Cran. Brit.' from Wetton Hill Barrow, being by no means rare in brachycephalic series.

Whatever differences may exist among craniographers as to the existence of sexual differences in the matter of the 'length-breadth index,' there is no room for questioning the fact that the height in women's skulls[1], very variable though this measurement is, holds usually a less favourable relation to the length and breadth than it does in males. The only three instances in which I have in this series of dolichocephalic skulls found the latitudinal to be less than the altitudinal index, or, in Professor Cleland's (l. c. p. 148) and Professor Busk's ('Journ. Ethn. Soc.' 1871, p. 467) language, found the skull to be 'tapeinocephalic,'

Weisbach, 'Arch. für Anthrop.' iii. 74, 75, 81; Broca, 'Rev. Anthr.' ii. 1, 1873, pp. 30–32. Very conflicting statements have been put forward as to the relative development in males and females of the posterior part of the cerebrum. I incline to hold that in most dolichocephalic races what Huschke calls the 'Zwischen-Scheitel-Hirn quae in fossis cerebri ossis occipitis liegt' is absolutely subequal to and therefore relatively greater than the homologous segment in males. As against this may be set the greater relative length of the basis cranii in males of our own as of other species. This is a difference however which amounts at most to about two millimeters, an excess insufficient to counterbalance that frequently observable in the female interparietal region. On the other hand, in typically brachycephalic races this absolutely and relatively shorter basis cranii and the absolute equality of the male and female intertuberal diameters in the parietal region do not rarely give female skulls a higher length-breadth index than male skulls of the same race possess.

[1] This point is well put forward by Weisbach, 'Archiv für Anth.' iii. 1. 66, 1868, in his account of the German female skull, which in this particular admits of wider application: 'Die Höhe unserer Weiberschädel von der Mitte des vorderen Randes des Grossen Hinterhauptloches zum Scheitel welche im Mittel nur 125 Mm. in den einzelnen Fällen 118 bis 139 Mm. beträgt ist wie alle bisherigen Maasse weniger veränderlich (16·8 Proc.), als beim Manne (21·8 Proc.), jedoch unter den drei Hauptdimensionen den Meisten Schwankungen zugänglich, die Breite den geringsten; während am männlichen Schädel die Länge die geringsten, Breite und Höhe fast die gleichen individuellen Schwankungen erleiden. Das Minimum der Höhe haben beide Geschlechter gemeinsam, wogegen die Maximalhöhe des Weiberschädels sich nur wenig über das Mittel des Männerschädels (133 Mm.) erhebt, dessen Maximum (147 Mm.) jenes des weiblichen Geschlechtes weit übertrifft. Die Höhe des Weiberschädels hat im Vergleiche zu der des männlichen noch das eigenthümliche vor den anderen Hauptdurchmessern voraus, dass sie von derselben sich viel weiter (♂ 1000, ♀ 939) entfernt, daher auch der Weiberschädel im Verhältnisse zu seiner Länge (1000: 729) viel niedriger als der männliche (738) ist.' Dr. Thurnam ('Further Researches,' p. 25), found as many as 8 out of 48 male skulls, and as many as 7 out of 19 female skulls, of the long-barrow period to be 'tapeinocephalic.' For 'the latest accession of height in the male skull being wanting in the female' see Cleland, l. c. 148, 164; for the reverse from the Caverne de l'Homme Mort, see 'Rev. d'Anthr.' ii. p. 29.

were skulls of women. One of these was the woman (see 'Journ. Anth. Inst.' vi. p. 36) found in one of the flint mines under the line of the fosse round the British fort at Cissbury, which were shown by Colonel Lane Fox ('Journ. Anth. Inst.' vol. v) to be of earlier date than that fort, itself of the stone age. The second of these was a woman's skull from the famous Rodmarton barrow, from the collection of the late Rev. Canon Lysons (see 'Proc. Soc. Antiq.' 1863; Thurnam, 'Crania Britannica,' Pl. 59); and the third of these was the skull of the single undisturbed skeleton found in the long barrow 'Upper Swell, ccxxxii,' described by me at p. 529 of 'British Barrows.' It is true that in many of the long-barrow skulls the loss of the anterior portion of the occipital bone renders it impossible to take the 'absolute' as opposed to the 'upright' height[1], except approximatively; still I am well assured that the great majority of the long-barrow crania resemble in the favourable relation of their height to their length rather the South Sea Melanesian 'hypsistenocephali' of Dr. Barnard Davis ('Natuurkundige Verhandelingen,' Haarlem 1866, and 'Thesaurus Craniorum,' p. 309) than the low-lying Tasmanian and Bushman skulls described by Professor Busk ('Journal Ethn. Soc. Lond.' Jan. 1871, p. 476). The conceptacula cerebelli lie horizontally in male and female skulls of the stone age both alike, differing herein markedly from the other type in which they are usually either globular and convex downwards or slope more or less obliquely upwards. In the norma occipitalis we often find given us the most characteristic peculiarities of the stone-period skull, and especially of the male skull. The sides of the pentagon described by the skull's contour are in such skulls (see 'Langton Wold, ii. 1,' pp. 204, 205) either quite vertical or even converge a little from the level of the tubera parietalia downwards, whilst they slope upwards with well-marked obliquity to a mesial vertical carina along the sagittal line. The tubera parietalia in 'ill-filled' male skulls are relatively more prominent than in the better developed, in which their site may be only very faintly marked; they are usually more distinct, whilst the mesial vertical carina is less distinct, its position indeed being only feebly indicated, in female skulls (see 'Sherburn Wold, vii. 1,' pp. 208, 209 supra). It is in the norma occipitalis as well as in the norma verticalis that the premature obliteration of the sutures to which Dr. Thurnam drew

[1] See p. 166 supra.

attention in the 'Natural History Review' of 1865 (see also Virchow, 'Archiv für Anthrop.' v. p. 535, 1872) as being very frequent in this type of cranium is specially obvious; and not rarely, though by no means universally, in the skulls of individuals in quite early stages of adult life (see pp. 211, 213 supra). It is rare in the brachycephalic series to see any traces of such anchylosis until many other senile changes have set in with advancing years.

In many of the stone-age dolichocephali, by combining the view given in the norma verticalis with that given in the norma occipitalis, we realise to ourselves very vividly the force of the epithets 'scaphocephalic' and 'kumbocephalic' (see p. 214 supra) which have been applied to them. The keeled mesial ridge and the lateral wall-sidedness given in the back view are often combined with a rapid tapering, both forwards and backwards, from the plane of the anteriorly situated parietal tubera, which suggests the comparison to a long and narrow boat which the epithets just quoted embody. On the other hand, it must be said that the contour presented by these skulls in the norma verticalis does, whilst always retaining the length in a relation of advantage to the breadth, yet vary considerably, as the other epithets 'birnförmig,' pear-shaped, 'keulenförmig,' club-shaped (='elongate oval'), and coffin-shaped (='cuneate oval') by various writers applied to them plainly indicate. In other words, these skulls when viewed in this as also in other aspects are seen, whilst remaining always dolichocephalous, to vary considerably as to being well or ill filled, globular or pinched, phaenozygous or aphaenozygous, rounded off or angular in the plane of greatest breadth, and finally to some extent even as to the relative position of this plane in the long axis of the skull.

As has been however already said, the conformation of the lower jaw in every well-marked variety of the human species is an eminently distinctive element in the complex aggregate of peculiarities which make up its cranial character. The presence of prognathism in the upper jaw is by no means a point of such consequence for distinguishing crania of prehistoric series *inter se*, as it is for distinguishing them from those of later and of modern races. For, as a matter of fact, prognathism, which is not always constant in its presence even in modern races reputedly prognathic, is by no means common in crania from the early interments of Britain

and France, nor, according to His and Rütimeyer[1], from those of Switzerland; nor, according to Virchow ('Archiv für Anth.' vi. pp. 92, 93), from those of Belgium. The dolichocephalic skulls with which we are now dealing contrast in no point more markedly with the Anglo-Saxon skulls to which so many authors have stated that they bear a very close resemblance, than they do in their comparatively slight and orthognathic upper jaw. And it may be emphatically asserted that in the after all not so very common cases in which the early British calvariae do closely resemble the Anglo-Saxon, the upper and lower jaws will almost invariably be found to furnish means for distinguishing them. The lower jaws procured from long barrows, as from other interments, very ordinarily far outnumber the calvariae which have been recovered in such a condition as to admit of reconstruction, and there is never the slightest difficulty in distinguishing such a series viewed as a whole from a similar series from an Anglo-Saxon cemetery simply by a reference to the more powerful development of the latter series. It is true that occasionally powerful lower jaws have been found belonging to prehistoric dolichocephalic crania. The existence of a 'frons valde depressa' (a conformation not usual in such skulls) noted by Sir R. C. Hoare ('Archaeologia,' xix. p. 46, 1821) as present in a skull from a long barrow at Stony Littleton may suggest the presence in that skull of a heavy jaw, to counterbalance which the brain-case may have been rotated backwards (see pp. 214 and 222 supra). In the eminently dolichocephalic (cephalic index 69) Ben-Djemma skull, rendered famous by the history given ('Types of Mankind,' p. xl) of its presentation by the Oriental scholar Fresnel to the American anthropologist Morton, a strikingly retreating forehead is correlated, Dr. Daniel Wilson informs us ('Edinburgh Philosophical Journal,' xviii. 1, July, 1863, p. 61), with a lower jaw which is 'large and massive, but with less of the prognathous development than in the superior maxillary.' In the Horned Cairn of Get, Caithness, which though not one of the oldest of those cairns did yet contain, as described by Mr. J. Anderson ('Mem. Soc. Anth. Lond.' iii. p. 220; 'Proc. Soc. Ant. Scot.' June 1868, p. 500), no metallic implements, but on the other hand with

[1] Herr Mandach, writing of an ancient skull in the Museum at Zurich, says, 'Räthselhaft aber bleibt immerhin das Auftreten dieses fast negerartigen Kopfes inmitten der sonst orthognathen alten Helvetier.' 'Crania Helvetica,' p. 63.

other worked flints an arrow-head of the early leaf-shape, a dolichocephalic skull (cephalic index 76) was found, of which Dr. C. Carter Blake writes, locc. citt., 'The inferior maxilla is very large and massive, the chin being excessively prominent; the inferior border is very thick and rounded, the posterior angle of the ascending ramus being rather obtuse. The sigmoid notch is not shallow.' And Virchow has ('Archiv für Anthropologie,' vi. p. 90, 1873) remarked of the numerous fragments of jaws recovered by Schmerling from the Engis Cave, that the upper jaws have usually a very wide, almost semicircular contour described by their alveolar processes, and have also their teeth very much worn away; and also that the lower jaws are strong, and their middle region much rounded out. Some of these cases may no doubt be considered to have been 'exceptional;' exceptional developments being by no means unknown in pure and pristine races; but I incline to think that in the great majority of cases in which such jaws have been procured from interments of the stone and bone age the epithets 'thick' and 'heavy' rather than 'well-developed' and 'powerful' will be found to be applicable to them. The segment of the body of such jaws which corresponds to their molar series is very often strikingly strong and even tumid, a development which one is tempted to refer to the stimulation hard food throws upon the teeth firstly and the jaw secondly. The jaw when placed upon a horizontal surface will be found in many cases to touch it by this segment only, the angle and symphysis both lying above it. The chin however and the angle of such jaws are found to contrast greatly to disadvantage with the similar regions of the powerful jaws of male subjects of races such as the Anglo-Saxon; either the depth of the prehistoric jaw of the middle line in front may be found to be markedly short; or when it is, as is sometimes the case, the very reverse of this, this depth is due much more to the alveolar part of the bone than to any increase in size of the triangular raised area of the mentum. A chin conformed in either of these two ways would have given an expression of feebleness to the face during life. In a really powerful jaw again the inter-angular diameter is wide, the angles approximate to right-angles, and in the region of these angles the jaw itself is flanged outwards, whereas the very reverse of this is usually the case in the jaws from the long barrows. A point less distinctly connected with the physiological development

and therefore of proportionately greater morphological value is presented to us in the shortness of the coronoid process relatively to the condyle-bearing portion of the ramus.

In this point these ancient dolichocephali resemble many modern Eskimo crania, indeed the frequency, almost amounting to constancy, with which it occurs in these modern savages is such as to render of less importance the fact that it is sometimes observable in other races both savage and civilised[1]. A second morphological peculiarity of similar significance is sometimes though by no means so frequently constituted by the backward position of the foramen mentale, an orifice which in modern European lower jaws opens in the plane of the anterior premolar, but in these priscan jaws sometimes occupies the more backwardly placed position not unusually noticeable in Negros.

The skeletons from the long barrows differ as markedly from those of the round as do the skulls. I have never found the stature to exceed 5 ft. 6 in. (see p. 539 of 'British Barrows;' 'Journ. Anthr. Instit.' v. Oct. 1875, p. 121) in any skeleton from a barrow which was undoubtedly of the stone and bone period. In this point my results are in close accordance with those of Dr. Thurnam ('Further Researches,' p. 32), who found the mean stature of the dolichocephalic men of the long barrows to be 5′ 5·4″ = 1·661 metre, and that of the brachycephalous men of the round barrows to be 5′ 8·4″ = 1·737 metre; the brachycephali having thus an advantage of no less than 3″ = 7·6 cent. in the matter of height[2]. To this I

[1] Schaafhausen, cit. Ecker, 'Archiv für Anthropologie,' iii. p. 134, 1868, speaks of a massive lower jaw with almost vertically ascending broad and short ramus, the processes of which are almost of the same height, as causing us to recognise the rough and more aboriginal type of conformation as it is known to us in the old Scandinavians, Celts, and Britons, and as it is in part at least presented to us in an exaggerated degree among modern savages. See 'Journal of Anth. Institute,' July 1876, vi. p. 34, for description of such a lower jaw from the Ancient British Flint-mine at Cissbury.

[2] Mr. J. R. Mortimer, 'Journal Anthrop. Institute,' vol. vi. 3, p. 333, Jan. 1877, has found that the mean stature of his skeletons with dolichocephalic skulls is as much as 5′ 9·4″, as against 5′ 5″ for the brachycephali, a very different result from those attained to by Dr. Thurnam and myself. The discrepancy however is very easily explained; Dr. Thurnam and I, when we speak of dolichocephali, are referring only to dolichocephali from long barrows, in which no metallic instruments are found, and all of which are anterior in date to the round barrows with which Mr. Mortimer is dealing. In these latter barrows, as the craniography of them shows, we have, in Yorkshire commonly and to some extent even in the South of England, to deal with a mixed race; and the effect of crossing, as will hereinafter be pointed out in the text, is very usually to increase the size of the mixed races. The only cremation long

would add that whilst this very striking difference is brought out by taking the average length of the two sets of femora, a simple inspection of the two sets of bones puts them into even sharper contrast. The longer femora very often are also the stronger in a most marked degree, and amongst them are to be seen bones with muscular ridges, and processes indicating the possession by their owners of strength far exceeding that usually observable in the skeletons of the earlier race. In like manner other bones indicate unmistakeably that the earlier was also the feebler folk as a whole, though humeri and femora are forthcoming from long barrows which show that men of great muscular power, even if not of great stature, were not wanting amongst the British tribes of the long-barrow period. In some cases the muscular ridges on the long-barrow bones are so well developed on comparatively ill-developed shafts as to suggest the idea of a poorly or only intermittently well-fed population which was constantly worked hardly. The large size of the deltoid ridge on some small humeri has suggested the perhaps fanciful hypothesis that the owners of such bones had been employed in lifting the stones of the huge barrows in which they were found entombed. The lineâ aspera on the femora of the British long barrows examined by me never attains the enormous development which caused Professor Busk and Dr. Falconer to call the femora from the Genista Cave at Gibraltar 'carinate' (see 'Trans. Internat. Congress, Prehistoric Archaeology,' 1868, p. 160), and which has suggested the name 'fémur à colonne' (Broca, 'Mémoires sur les Ossemens des Eyzies,' pp. 14–21, Paris, 1868; Topinard, 'Anthropologie,' p. 324, 1876) for similar femora from early sepultures. In the absence of this peculiarity [1], as also of the

barrows which have been examined in Yorkshire are those described in 'British Barrows' from Rudstone, Ebberston, and Kepwick. The great majority of the statements here made as to the characteristics of the dolichocephalic stock are based upon the examination of skeletons of an unmixed race from the pre-metallic tumuli of Gloucestershire.

[1] Topinard has remarked, l. c. p. 325 (if I am right in supposing that the word 'crânienne,' line 11 from top of page cited, stands by a misprint for the word 'olécrânienne'), that the fluted femur is not found in the same collections of bones as the perforated olecranic fossa. No humerus with such perforation was found in the Genista Cave at Gibraltar, where so many carinate or fluted femora were found by Messrs. Busk and Falconer. I should be slow however to think, as M. Topinard does, that the presence or absence of one or other of these peculiarities indicates a difference of race. As I have said in a detailed account ('Journ. Anthrop. Instit,' Oct. 1875, p. 149) of the Osteology of the long barrow at Nether Swell, I should agree

fluting of the fibula and of the sabre-shape of the tibia which are found to accompany it, these skeletons contrast with many of the probably earlier skeletons described by the authors just referred to.

It has been stated above, p. 244, that many craniographers have found it difficult to distinguish between the crania of the Celtic and the Teutonic races, or, in the words of the German antiquary, between the crania of the 'Steingräber[1],' the analogues of our long barrows, and the 'Reihen-gräber' period. It is almost needless to say that the strength and length and other characteristics of the Anglo-Saxon skeletons found buried with such accompaniments[2] as to justify us in referring them to early periods in the Anglo-Saxon conquest of this island will enable any osteologist to distinguish them from the stone-period skeletons.

A more detailed comparison of these two sets of skeletons with each other and with those of the bronze age brings out further points of difference between them, and throws a most instructive light upon the social condition of the respective periods. One of these points is the great inferiority of size of the female skeletons belonging to the earlier period as compared with those of the later, or with the male skeletons of their own times. It is easy to understand[3] how the German women came to be almost equal to the men

with M. Broca in assigning such perforated humeri to female skeletons, and their presence there I should explain by what follows, pp. 257, 258 infra, as to the harder lot and slighter build of the females in savage tribes.

[1] A very copious list of synonyms for graves of the stone period is given by Weinhold ('Sitzungsberichte d. k. Akad. der phil. hist. Cl.,' Bd. xxix. Heft. 2, 1859, pp. 119, 121). His words are—'Sie heissen in Dänemark Steendysser, in England Cromlechs, in Frankreich Pierres plates oder Grottes aux fées, in Deutschland gewöhnlich Hünengräber. Andere Namen sind Hünenkeller, Hünentritte, Hünenberge, Riesenbetten, Riesenkeller, Zwerg- oder Quargberge, Teufelsbetten, Teufelsaltäre, Teufelskanzel, Teufelsküchen, Steinhäuser, Steinöfen, Carlsteine, Schluppsteine, Weinberge.' For the single variety of Steingräber which is known as Hünenbetten, and corresponds to our 'long barrows with peristaliths' (for which see Thurnam, 'Archaeologia,' xlii. 1869, p. 51), there exist the following German (l. c. p. 121) synonyms: Hünenhügel, Hünenstatt, Hünenburg, Hühnentritt, Hühnenkirchoff, Riesenbetten, Riesenberg, Teufelsberg, Bulterbelt, Dansenstein, Danzelstein, Danzelberg, Steintanz, Sonnenstein, Wulfstein, Steinkirche, Steinkreis. This multitude of names is a proof of the age of these monuments, nearly as convincing as the presence of stone- and bone- and the absence of metallic implements.

[2] For an account of these accompaniments see 'Archaeologia,' xlii. 1870; 'Excavations at Frilford,' p. 436 seqq.

[3] Dr. Leonard Schmidt, art. 'Germania,' Smith's 'Dictionary of Greek and Roman Geography,' p. 995.

both in strength and in size when we read (Tacitus, 'Germania,' cap. 16) that their marriage-presents of 'juncti boves, paratus equus, data arma' were intended to teach them symbolically 'venire se laborum periculorumque socias, idem in pace, idem in proelio passuras ausurasque.' In women subjected to such equal trials, and incited to such equal aspirations, the great sexual disparities at once of a physical, moral and intellectual nature, which have so often been noted as well in more civilised as in more savage communities, would on principles of natural selection tend to disappear. That the series of skeletons from the bronze period also contrasts and in the same way with the series from the stone and bone period, may be gathered from the fact that in the series from the later period there is from time to time a difficulty in distinguishing the sex of the skeletons when the entire number of the bones are not preserved, a difficulty which scarcely ever arises in the case of pre-metallic skeletons. The subequality in size of the sexes in the Gallic races was expressly noted by Diodorus, and many other writers, ancient as regards our times but entirely modern as regards the long-barrow era, have, as I have pointed out above, p. 170, remarked that in Celtic, no less than in German tribes, both sexes exposed themselves to the same risks in war. To the British of the time of Boadicea, Tacitus[1] tells us ('Ann.' xiv. 35), it was 'solitum feminarum ductu bellare[2];' and the presence and participation of women in governments, battles, and massacres is repeatedly mentioned by the same writer (see 'Agricola,' 16, 31, 32; 'Germania,' 8; 'Ann.' xiv. 30. See also Diodorus, v. 32, 39; Strabo, iii. 4, 17, 18, vii. 2, 3; Dio Cassius, lxii. 4; and supra, p. 170).

The words of Dio Cassius[3], a historian deserving, even as

[1] Tacitus of course is writing (locc. citt.) of races whom the antiquary would speak of as 'late Celts,' but the physical subequality which this community of risks as incurred in his days must have entailed had existed in the much earlier bronze age; and the brachycephalic type persisted not only through the late Celtic period, but, as the examination of the Oxfordshire Crawley tumulus carried on by Mr. Akerman, Dr. Thurnam, and myself has shown, to a much later period. Indeed in this tumulus the crania were almost exclusively brachycephalic, and to a most marked degree, while the skeletons possessed the size and strength already described (p. 253 supra) as being usually found to characterise the trunk and limb bones, to which such crania appertain. For an account of the Crawley tumulus, see Akerman, 'Archaeologia,' xxxvii. p. 432; Thurnam, ibid. xlii. p. 175.

[2] See p. 170 supra, and Bates, 'Naturalist on the Amazons,' ii. 132; Clements Markham, 'Travels in Peru and India,' p. 159; Rochholtz, 'Deutsche Glaube,' ii. 289.

[3] Βουνδουΐκα γυνὴ Βρεττανὶς, γένους τοῦ βασιλείου, μεῖζον ἢ κατὰ γυναῖκα φρόνημα

abridged, of being more frequently quoted than he is, as to the size and appearance of the British heroine, give us some colour of reason for suggesting that Boadicea may have possessed the cranial conformation characteristic of the bronze age, rather than that which we have at Arras in the East Riding and elsewhere found in interments with the archaeological accompaniment of the late Celtic or early Iron period in this country.

On the other hand, a collection of the trunk and limb bones from one of the long barrows described above as examined in the neighbouring county of Gloucester (as e.g. p. 538 of 'British Barrows') contrasts in no point more strikingly with a similar collection from such a tumulus as the one at Crawley than in the disproportionate slightness and shortness of the female skeletons. The average difference in civilised races in the stature of men and women may be taken as about four inches, being in England at present the difference between about 68″ and 64″; twice this difference will very usually be found to exist between the male and female skeletons of the stone and bone period, being the difference between about 66″ and 58″. The male skeletons of this period contrast to disadvantage with the male skeletons of each and all of the races who have inhabited this country since the introduction of metal into it; but the difference between the female and the male skeletons of this early period is a very much greater difference than any which can be shown to arise out of the comparison of any other two sets of adult human bones from cemeteries in this country. This difference is perhaps more strikingly shown by a comparison of the male and female collar-bones than by that of any other bones of the skeleton; and it enables us to reproduce for ourselves the narrow chest and drooping shoulders which must have given their

ἔχουσα . . . ἦν δὲ καὶ τὸ σῶμα μεγίστη καὶ τὸ εἶδος βλοσυρωτάτη τό τε βλέμμα δριμυτάτη· καὶ τὸ φθέγμα τραχὺ εἶχε· τήν τε κόμην πλείστην τε καὶ ξανθοτάτην μέχρι τῶν γλουτῶν καθεῖτο. 'Boadicea, a British woman of the royal family, had more than a woman's spirit. She was of very large bodily proportions; the fierceness of her appearance struck beholders with awe; the expression of her countenance was exceedingly severe and piercing. Her voice was harsh, and she had a profusion of very light hair, which reached down to her hips.' Lib. lxii. 701, ed. Leunclavii, 1606. It is not impossible to reconcile this account with Martial's lines, xi. 53–56:—

'Claudia caeruleis quum sit Rufina Britannis
Edita quam Latiae pectora plebis habet.
Quale decus formae, Romanam credere matres
Italides possunt, Atthides esse suam.'

owners an appearance of great feebleness during life. It has been noted by Professor Busk in the skeletons from the Gibraltar caves (see 'Trans. Internat. Congress, Prehist. Archaeology,' 1869, p. 158), and I have noted it in every case in which the trunk bones have been recovered from long barrows. It is as marked in the female clavicles from the cremation long barrows of Market Weighton and Crosby Garrett as in the non-cremation long barrows of Gloucestershire.

As regards the skeletons of the stone age which have been examined in this country, the aphorism enunciated by Dr. Kuhff ('Revue d'Anthropologie,' iv. 3, 1875, p. 435) to the effect that 'plus l'on se rapproche des origines de l'homme, plus l'on voit s'effacer les caractères différentiels sexuels dans la squelette' appears to me to be the very reverse of the actual state of the case, though the skulls are not rarely subequal in the two sexes. The reason for this disproportion[1] lies in the facts of the earlier attainment

[1] The greatest discrepancy in the stature of the two sexes recorded by Weisbach in his measurements in the Anthropological part of the 'Voyage of the Novara' (1867, p. 217) is that observed in the Javanese, where the males were found to average 1679 mm. = nearly 5′ 6″ in stature, as against 1461 mm. = nearly 4′ 9·5″ for the females. The Rev. Richard Abbay, Fellow of Wadham College, tells me that the Javane e women are put to very hard labour, carrying enormous weights upon their backs. The philologist who may be inclined to explain the existence of Turanian or non-Aryan traits in Welsh and Irish grammar, by supposing that these traits are the result of the assimilation by bronze-importing Celts of the supposed non-Aryan tribes of the stone age, may be interested in comparing the following account of the treatment of the Mongolian female in modern days with the foregoing description of the osteological characters of the female of our long-barrow period. The Rev. James Gilmour, Medical Missionary at Peking, writes thus in the Eleventh Report of the London Missionary Society's Hospital at Peking, 1875, p. 37: 'The women of Mongolia are hardy and capable. They look ruddy and strong-limbed. They work hard, and are badly treated. Woman's place in the tent is next the door; the felt she sleeps on is the thinnest and poorest. She does the milking and the drudgery generally, and when she sits in the tent, usually has nothing better than a worn cow-hide to protect her from the damp and cold of the ground. She jumps into the saddle and rides over the plains as recklessly as a man. She takes little care of herself, and has little care bestowed upon her. An old woman spoke some truth, at least, when she said to me, "The women are treated like the dogs which are fed outside the tent." The result is as might have been expected: strong, hardy and healthy as the women look, almost every one who has passed the stage of girlhood has some chronic malady or suffering. There are many exceptions, especially among the richer class; but as a rule, women suffer more, age sooner, and die younger than the men; and there is little prospect of a change for the better in this respect, till women are treated more considerately, and have accorded to them a fair share of the meagre comforts of tent-life.' Diodorus Siculus, again (v. 39), after dwelling with

of puberty by females than by males in our species, and the earlier consequent consignment of the females, in savage varieties of it, to the growth-arresting processes of child-bearing, and of hard work on a frequently poor and intermittent supply of food.

It has often been stated that in savage races the cubic capacity of the skulls of the women makes a nearer approach to that of the men than it does in modern civilised nations, and there is no doubt that this has often been found to be so. But I have to repeat (see p. 565 of 'British Barrows') that this is by no means invariably the case, and that in the long barrows, alike of Gloucestershire and Yorkshire, I have found female adult crania which contrast with the male skulls by their disproportionate smallness, almost, or altogether as forcibly as do the clavicles or the long bones. Having taken up these diminutive skulls myself, I can point out that they were found together with

emphasis on the hard life of the race which Vergil speaks of as 'assuetum malo Ligurem,' says that the wives take an equal share with their husbands in all their toils and endurances. The craniographer may object to the relevancy of these striking passages, on the ground that the Mongolian are a brachycephalic and the long-barrow folk, like the Basques, a dolichocephalic stock. To this the non-anatomical enquirer might reply that the question was not one of human osteology, but of human motives and behaviour; but writing as a craniographer I will answer, firstly, that I have received from Professor Eichwald a Tartar skull from Kazan with a cephalic index of 76, and a very close general resemblance to the Eskimo type; and secondly, that most ethnographers are agreed, dolichocephaly notwithstanding, to consider this latter stock as unmistakeably Mongolian. For the Australians, whom their mode of life and command or want of command of its comforts as well as some other peculiarities have caused to be compared with the stone-age inhabitants of this island, Dr. Barnard Davis gives an average male stature of 5′ 6″, and an average female stature of 4′ 11·5″,—measurements showing a disproportion nearly identical with that which I have pointed out as characterising the race we are here dealing with. The Amakosa Kaffirs of the Cape of Good Hope have, I was assured by the late Sir A. Smith, an average stature of 5′ 8·5″ for the males, as against one of 5′ 0·5″ for the females. On the other hand, amongst the Eskimos, to whom, as to the Australians, these prehistoric races have been compared, I do not find that a similar disproportion exists in the stature of the two sexes, though Sir John Richardson ('Polar Regions,' 1861, p. 303) does speak of 'the discomforts which age entails in savage life, especially on the weaker sex,' as having made the old women 'frightfully ugly,' and 'the presence of a cheerful and pleasant-looking old woman' as 'rare indeed among them.' The stature of the male Eskimo as given by Peschel ('Völkerkunde,' p. 87), citing Beechey, is on an average 5′ 5″, and exceeds that of the female by only 4″. I must express my regret that Dr. Emil Bessels should have been so unfortunate as to lose his measurements of the stature of the Eskimos, whose ethnology owes so much to his interesting paper in the 'Archiv für Anthropologie,' viii. 1875, p. 109. The results of these measurements might perhaps have given us a different average from that just quoted. A few additional references to the significance of this disparity of stature in the sexes may be found in the 'Archaeologia,' xlii. 1870, p. 457, and 'Journal Anth. Inst. Lond.,' Oct. 1875, p. 121.

other skulls, male and female, which differed from them greatly in size, but in no way as to the archaeological surroundings; and that there is no reason for supposing, therefore, that their smaller size is to be explained by reference to any inferiority of rank which among savages has so often been observed to entail inferiority of bulk (see 'British Association Report,' Bristol Meeting, 1875, pp. 150–152). We are prone, as I think, by a certain confusion of thought, to imagine that savage life is as unvarying and monotonous, and as little relieved by alternations, as is the 'dull grey life' of the lowest ranks of highly civilised communities, and that in consequence greater uniformity of physical conformation is to be expected and to be found among all the members of wild and prehistoric races. The assumption, and the inference based upon it, are equally unsubstantial; savages are exposed to greater vicissitudes in their battle alike with inanimate and animate forces than are the veriest outcasts of civilised society; and as regards the means of meeting these emergencies, compared with savages 'our basest beggars are superfluous.' 'The action of the environment,' 'l'influence des milieux,' counts really for more instead of for less upon savage than upon civilised man; and as a matter of fact this more potent working is as distinctly verifiable upon the living modern savage as it is upon a series of bones from the stone-age barrows. Mr. Bates, e. g. says, when ('Naturalist on the Amazons,' vol. ii. p. 129) writing of a Brazilian tribe, the Mundurucús (whom, he says indeed, p. 131, it would be a misnomer to call 'savages; their regular mode of life, agricultural habits, loyalty to their chiefs, fidelity to treaties, and gentleness of demeanour giving them a right to a better title,' but who nevertheless, on his own showing as to details such as dress, &c., p. 125, appear to have owed very little to civilisation and the arts): 'The great difference in figure, shape of head, and arrangement of features amongst these people struck me forcibly, and showed how little uniformity there is in these respects amongst the Brazilian Indians, even when belonging to the same tribe. The only points in which they all closely resembled each other were the long thick straight jet-black hair, the warm coppery-brown tint of the skin, and the quiet rather dull expression of countenance. I saw no countenance so debased in expression as many seen amongst the Múra tribe, and no head of the Mongolian type, broad with high cheek bones, and oblique position of the eyes,

of which single examples occur amongst the semi-civilised canoemen on the river.' The fact, finally, of the existence in certain uncivilised races of a far greater difference between the skulls of the women and those of the men than that which exists in European races, is put forward with emphasis by Dr. Zuckerkandl, in the 'Reise der Novara,' Anthrop. Theil, i. 1875, p. iii; and, besides proving, when compared with the utterances of Retzius, Huschke, and Broca, to precisely the opposite effect, the variability of savage female crania, brings, when compared with the results of an examination of female long-barrow crania, a fresh illustration of the importance of collecting, while yet we may, all the available facts for the illustration of ancient savage life.

In saying that the dolichocephalic skeletons of the long-barrow period contrast in the points of strength and stature to disadvantage with those of the bronze age, it is by no means intended to assert that ill-filled skulls and stunted skeletons are never to be found in the brachycephalic series. The very reverse of this indeed has been already, p. 189, pointed out as being the state of the case. The races of the bronze age were in possession of larger means for carrying on the battle of life than those of the stone age; still, they lived in latitudes which we are sometimes tempted to think are only made endurable by the command of glass, and coal, and iron; and they must, like races in more modern times in a somewhat similar stage of development, have from time to time suffered greatly from famines. Suffering from scarcity of food at a critical period of growth is sufficient to stunt the stature of individuals even of tall races who may be subjected to it. The chiefs would be less liable than the common people to be so affected; Mr. Bates indeed tells us of a Brazilian tribe ('Naturalist on the Amazons,' ii. p. 127) how the 'footmarks of the chief could be distinguished from the rest by their great size and the length of the stride;' still, a long-continued succession of murrains and bad harvests would affect all classes alike, even in the bronze as well as the stone age. The stature would be more likely to be affected by the operation of such times of scarcity than would the size of the head, as it goes on increasing for so many years, possibly years of scarcity, after the full proportions of the cranium are attained to[1]. But small and

[1] The average circumference of the head has been shown by Liharzig ('Das Gesetz des Wachsthums,' Tab. v. and vi.) to be but a little over an inch less in either sex at

ill-filled skulls as well as short skeletons are to be found in the brachycephalic[1] as well as in the dolichocephalic series, even if not in equal proportion; their smaller numbers being correlated with their greater command of means, such as metal and cerealia. I have elsewhere given[2] at length the peculiarities which are

the age of fourteen than it is in adult life, the exact measurements giving a difference of 3 centimètres = 1·181″ for each sex, and being 54 : 57 centimètres for males, and 52·5 : 53·5 for females. The potential increment of the stature subsequently to the age of fourteen averages, according to the same authority, 12 centimètres = 4·72 inches for males, being the difference between 163 centimètres = 64·17 inches, and 175 centimètres = 68·89 inches; and 12 centimètres = 4·72 inches for females, being the difference between 161 centimètres = 63·38 inches, and 173 centimètres = 67·11 inches. But here Liharzig appears to underestimate the average difference between the sexes at the age of twenty-five. See Taff. iv. and v. and p. 15.

[1] Such for example are the brachycephalic skulls of which a record is given under the following titles and at the specified pages of 'British Barrows':—'Goodmanham, cxvii. 1,' p. 326; 'Rudstone, lxiii. 3,' and '6,' p. 248; 'Rudstone, lxvi. 1,' p. 254; 'Rudstone, ccxxxiv. 4,' p. 555; 'Weaverthorpe, xlvi. 4,' p. 200; 'Weaverthorpe, xlvii. 5,' p. 195; 'Brough, xxi. 6,' p. 163; 'Flixton, lxxi. 6,' p. 276; 'Sherburn Wold, ix. 2,' p. 148. With these skulls may be compared the Ancient British Skull from Codford figured in the 'Crania Britannica,' pl. xiv., by Dr. Barnard Davis; in the 'Canadian Journal,' No. xli., Sept. 1862, by Professor Daniel Wilson, and stated to have a cubical content of 82 cub. inches, a circumference of 20 inches, and a cephalic index of 83. Such again is the Danish cranium from Moen, a cast of which (No. 5710) may be seen in the Museum of the London College of Surgeons; and such would appear to be the skulls described by Hölder as the female form of his 'Ligurian' type, 'Archiv für Anthropologie,' ii. p. 55. As also the female skulls described by me, 'Archaeologia,' xlii. p. 457.

[2] See 'Journal Anthrop. Instit.' Oct. 1875, vol. v. pp. 124, 125, where I write as follows:—

'By an "ill-filled" skull, Professor Cleland tells us, he means a skull the exterior surface of which is marked by a "mesial and two lateral ridges on the roof, with flatness of the adjacent surfaces," which has "its position of greatest breadth high up upon the parietal bones." The mesial carina may, I would add, be prolonged in such skulls over the frontal bone, and the frontal tubera may retain their infant-like prominence. To these peculiarities I would further add the presence of two depressions on the exterior of the skull, corresponding to convexities on its interior surface, as completing in many ancient and modern savage crania the character of "ill-filledness." One of these depressions is well known as the "post-coronal furrow," but inasmuch as the mesial vertical carina often developed in male skulls may be, and often is, continued along the line of the sagittal suture, so as to divide the so-called "furrow" into two parts, this name is not a happy one. The second of these depressions corresponds to a part of the parietal bone which lies a little above its posterior inferior angle, and immediately, therefore, above the part of the bone which is furrowed internally for the lateral sinuses. As in the former case, an inward growth corresponds to the outwardly visible concavity, so that much such an appearance is produced as we can imagine would have resulted from pinching in the skull walls over this area, had they been plastic. I have been able to demonstrate the rationale of these depressions in the following manner. By removing from a skull, with its brain *in situ*, the greater part of its roof, but leaving of this structure one antero-posteriorly-running arch of bone,

intended to be implied by the application of Professor Cleland's expressive epithet 'ill-filled;' I may here add that a good *rationale* of most of them, such for example as their wall-sidedness, their retention of the prominence of frontal and parietal tubera, and the stops on either side of their sagittal vertical line, is given in the

corresponding to the sagittal, and two transversely-running half-arches, corresponding respectively to the half of the coronal and the half of the lambdoid sutures on one side, the exact position of all the main convolutions and fissures of the brain can be shown in their normal relations to these landmarks in the vault of the skull. It will make the matter plainer, and at the same time facilitate the production of similar preparations in other museums, to say that a brain under such surroundings presents something of the appearance in the skull which a living head does when subjected to measurement in such a cephalometer as that of M. Antelme (see 'Mém. Soc. Anthrop. de Paris,' tom. i. pl. vi. fig. 2). By means of such a preparation it is easy to show that the post-coronal depression in the roof of the skull does not correspond, as supposed by the late Dr. Thurnam ('Nat. Hist. Review,' April 1, 1865, p. 267), to the fissure of Rolando, but to the deep, often wide, fissure which divides the superior frontal convolution into two well-defined lobes, and abuts upon the ascending frontal convolution by a terminal bifurcation into two arms of considerable length. This fissure, as is well known, exists, and has often been described and figured, in the brains of the anthropomorphous apes, in the crania of which animals the post-coronal depression is sometimes indicated when the sagittal carina is absent. Similarly, the second of the depressions which I have noted as commonly present in the postero-inferior part of the parietals of "ill-filled" skulls, may be seen to correspond to a certain multi-radiate fissure frequently noticeable on the posterior or convex aspect of the middle temporo-sphenoidal convolution, but as far as I know, not named by any of the numerous writers who have followed Gratiolet in describing the convolutions and fissures of the cerebrum.

'Professor Bischoff however, in his well-known paper on "Die Grosshirnwindungen des Menschen" (in the "Abhandlungen der k. Bayer. Akademie der Wiss." ii. Classe, x. Band, ii. Abtheil. 1868, pp. 448, 450, 495; or "Separat-Abdruck," pp. 58, 60, 105, Tafel x. fig. 7) speaks of certain fissures, without any well-defined character, which appear on the boundary between the parietal and occipital lobes, and says that they correspond to a "fissura occipitalis externa" which appears in the human foetus, but is normally limited in duration to the seventh and eighth months of intra-uterine life. Though brachycephalic skulls have not as yet been proved to have been found in Great Britain in any primary interments in the barrows of which I am writing, and though brachycephalic skulls from the United Kingdom and indeed, I am inclined to think, from European countries generally, are ordinarily well- and not "ill-filled" skulls, it may, nevertheless, be allowable to say here that the "brachycephali angustiores" (see "Phil. Trans." 1870, p. 148), as Professor Cleland would call the brachycephali of several other parts of the world, frequently present the depressions of which I have been writing. An excellent instance of the postero-parietal inward pinching of the skull-walls was furnished to me quite recently by a Maori skull presented to the University Museum by Dr. Batt, the skull having a latitudinal index of 79, and possessing also markedly the contour which induced Retzius to class the Maoris as brachycephali.' Since writing as above, I have noted on both sides of the brain of a Malay a depression which must have had a very considerable postero-parietal depression of the cranial walls corresponding to it.

metaphysical expression 'the retention of an infantile type,' which refers us to causes such as scarcity of food which arrested potential growth. The fact that the dimensions of the parietal bones are usually less affected by any general stunting to which skulls may have been subjected than those of either frontal or occipital is a very striking illustration of this, it being well known that the two latter factors of the brain-case attain their normal relation to the parietal only after several years of childhood with its numerous liabilities to disease and distress have passed away. None, however, of these prehistoric skulls have exhibited that extreme lowness and smallness and precoronal depression of the frontal bone which is seen in some of the skulls from the Melanesian Islands and Australia, though in some of the hypsistemocephali of the long barrows we do observe that relatively greater prominence of some one segment in the anterior half of the parietal in the sagittal line which is often observable in skulls of this kind (see Dr. B. Davis, 'Natuurkund. Verhand.' Haarlem 1866, Deel 24, Pl. i. fig. i; Busk, 'Anthrop. Instit.' vi. 3, Jan. 1877, Pl. ix–xii).

The small skulls of which I am speaking are sometimes, and especially when belonging to males of the brachycephalic type, of considerable textural solidity[1], but I incline to think that it is more usual to find their ill-nourished character expressed by a slighter structure and a lesser relative weight as well as by their smaller dimensions. As I have already hinted (see pp. 190 and 237 supra), I am inclined to think that it may have been the mal-nutrition of such skulls as these which gave origin to the hypothesis of a Lapp population having existed in prehistoric times in Denmark, South Sweden, and in these islands. Latitudes much further south than Great Britain went undoubtedly through a reindeer period, but, without questioning this, we can stop short of averring that the men who domesticated these animals in prehistoric Southern Europe were of the same stock as the men who domesticate them now in Northern Europe. The skulls of the modern Lapps do not closely resemble either the stone and bone period skulls, or our bronze period skulls; neither of these periods coincided with the

[1] Such is the Ancient British Skull from Codford described by Dr. B. Davis, 'Cran. Brit.,' pl. 14, as being 'dense in its structure and rather heavy;' and such are a considerable number of skulls of the Romano-British period described by me as found at Frilford, 'Archaeologia,' xlii. p. 458.

reindeer period, whilst in both of them small stunted crania are found mixed up with large ones, and that too in the tombs 'of the kings[1].'

To obtain however any really satisfactory *rationale* of the difference between brachycephaly and dolichocephaly we must go beyond examination simply of the texture, relative proportion, and capacity of the skulls, and must enquire what the conformation of the covering skull can teach us of the conformation and character of the contained brain. As I have already pointed out (p. 638), Huschke, nearly a quarter of a century ago, stated of certain readily recognisable landmarks on the skull, such as the frontal and parietal tubera and the coronal and the lambdoidal sutures, that certain equally definite and recognisable brain-convolutions would be found to correspond with them. These important observations, owing probably to their being mixed up with a vast mass of matter of less precision and interest, failed to attract the attention which they deserved, and a considerable number of investigators, including myself[2], have subsequently to the appearance of Huschke's memoir

[1] A considerable amount of discussion upon the subject of the Lapp hypothesis took place at the Meeting of the International Congress of Prehistoric Anthropology and Archaeology held at Stockholm in 1874; the opinions of the following authors, mostly in disfavour of the hypothesis, will be found at the pages of the Compte Rendu of the Congress (published last year, 1876) which I append to their names:—Rygh, pp. 178-179; Montelius, p. 194; Worsaae, p. 208; Gustav Retzius, pp. 231–233; Schaafhausen, p. 841; Virchow, p. 848; Baron von Düben's views, pp. 691–692, have already been quoted, p. 225 supra, and the following extract from Mr. Smiles' 'Life of a Scotch Naturalist, Thomas Edward,' 1876, p. 357, looks a little strange when compared with it: 'It is probable that a great part of Europe was originally peopled by Lapps, and that they were driven North by the incoming of a more civilised race from the East. There are still remnants of the Lapps in the Island of Malmön off the coast of Sweden, in North Connaught, and the Island of Aran in Ireland; in the Island of Lewis off the Western Coast of Scotland, and in several of the Shetland Islands.'

So far as I know, Professor Nilsson's ('Skandinaviska Nordens Ur-invanare,' Lund 1838–1843, Hft. 3, p. 12) and Professor Rask's names are connected with the origination of this hypothesis. The views of the former of these authors appear to have been considerably modified in the thirty years' interval between 1838 and the publication of an English translation of his work under the editorship of Sir John Lubbock (see p. 122 of this translation).

The views of the elder Retzius may be seen in 'Müller's Archiv,' 1845, or 'Ethnologische Schriften,' 1864, p. 20; and 'Müller's Archiv,' 1849, and 'Ethn. Schriften,' p. 102. The small skulls described by Retzius, from Marly and Meudon near Versailles ('Müller's Archiv,' 1847, p. 499, and 'Ethn. Schriften,' pp. 62-64), furnish instances of stunted skulls the existence of which can be explained as in the text.

[2] Professor Broca in France, Professor Turner in England, M. Ferdinand Heftler in Russia, and Professor Bischoff in Germany, have connected their names with this

in 1854 examined the relation of brains and skulls *in situ* without any knowledge of his precedence, but with the result of confirming his statements. Of these there are two which are of eminent importance for our present purpose, the one namely which allocates the supra-marginal convolution of the brain to the parietal eminence in the skull (see Huschke, 'Schädel, Hirn, und Seele,' p. 142); and a second, according to which the internal perpendicular or parieto-occipital fissure[1] holds a similar relation to the lambdoid suture (Huschke, l.c. pp. 62, 142). For as I have already said (p. 234), of all the peculiarities distinguishing the brachycephalic from the dolichocephalic skull, at least in European races, there is none more important and more striking, even from a merely craniological point of view, than the difference existing between them as to the distance intervening between the plane of the parietal eminences and that of the back of the skull. When however we come to look into this difference a little more closely, we find that if we take for our posterior limit, not the posterior aspect of the skull but the plane of the lambdoid suture, the two varieties of skull are just as clearly differentiated as before. For the relative proportions of that portion of the cerebral cranium which is constituted by the superior squama occipitis and lodges the occipital lobe proper, and the relative proportions of that lobe itself, are exceedingly variable[2]

investigation; an account of their labours is given by Professor Broca in his memoir 'Sur la Topographie Cranio-cérébrale,' published in the 'Revue d'Anthropologie,' tom. v. No. 2, 1876.

[1] Professor Turner ('Journal of Anatomy and Physiology,' Series ii. No. xiii. Nov. 1873, p. 145) says that the 'exact distance of the parieto-occipital fissure from the apex of the lambdoidal suture varies, partly from variations in the brain itself, and partly from the not infrequent variations in the mode of ossification of the upper squamous part of the occipital bone. About 0·7 or 0·8 of an inch will express its average distance from the apex of that suture.' In this Professor Turner differs from Ecker, 'Arch. für Anth.' ix. 1876, pp. 72 and 76; and from Broca and Bischoff, citt. in loco. Broca, in the 'Revue d'Anthropologie,' tom. v. No. 2, 1876, says: 'La scissure occipitale externe correspond assez ordinairement chez les adultes de notre race à la suture lambdoide, à quelques millimètres près; toutefois elle peut s'en écarter davantage, soit en dessus, soit en dessous.' These statements are mainly of importance as bearing upon the variability of the occipital lobes, to which reference has been made above and will be also in the next note.

[2] The occipital lobe is supplied exclusively by the posterior cerebral artery, which, on account of the angle which it makes with the main trunk whence it arises, the basilar, namely, or, on the right side, very frequently the internal carotid, as also on account of its great length, must work at very considerable hydraulic disadvantage. What the peculiar course of the artery would lead us to anticipate,

in each variety of skull, and are not (see p. 235) distinctive of either. A zone therefore bounded in front by a line drawn over

the peculiarities of the veins of this portion of the cerebrum confirm us in holding. One of the largest of the Pacchionian bodies is ordinarily found at the point where the veins of the occipital lobe enter the superior longitudinal sinus, this point being upon the line of the parieto-occipital fissure, and corresponding with what is usually the most posteriorly placed of the foveae glandulares in the skull. Now the bodies known as Pacchionian glands are growths which in their normal state are but $\frac{1}{10}$-$\frac{1}{8}$ mill. in size, and which owe the increase in size which makes them prominent to the eye and impresses them on the skull to venous congestion. The very constant presence therefore of a largely hypertrophied Pacchionian body upon the embouchure of the occipital veins is a significant fact as regards the retardation of their current (Wilks and Moxon, in their 'Pathological Anatomy,' p. 208, compare these bodies to the papillose outgrowths sometimes seen on the surface of the liver in cases of extreme cardiac congestion). The amenability of the Pacchionian bodies to pathological change is recognised by Rokitansky, 'Pathological Anatomy,' English translation, 1850, vol. iii. p. 329, or 2nd German edition, 1856, vol. ii. p. 407; by Jones and Sieveking, in their 'Manual of Pathological Anatomy,' edited by Dr. J. Frank Payne, 1875, p. 237; by Wilhelm Krause, in his 'Handbuch der menschlichen Anatomie,' 3rd ed., 1876, p. 460; and finally by Luschka, who was, as far as I know, the first to draw attention to the fact that in their earlier stages and smaller size these bodies could not be considered other than normal growths, in his 'Anatomie des Menschen,' 1865, Bd. iii. Abtheilung ii. p. 240.

The histological inferiority of the occipital lobe is well known, and though Mr. Lockart Clarke may slightly overstate the case when he says (Maudsley, 'Physiology of Mind,' 3rd edition, 1876, pp. 112 and 114) that 'all the nerve-cells are small,' both Professor Turner ('Introduction to Human Anatomy,' part i. 1875, p. 283) and Professor Henle ('Handbuch der syst. Anatomie,' iii. 2, p. 276) would allow that 'the greater number of the cells of the occipital lobe are small and nearly uniform in size,' and, what is of equal importance, that the superficial layer, which is everywhere poor in cell-elements, is of greater width in the occipital than in any other region of the brain. Meynert's words ('Stricker's Manual of Human and Comparative Histology,' English translation by Power, vol. ii. p. 391, 1872) are eminently to the purpose: 'The brain of monkeys, which is distinguished by excessive development of the occipital lobes, contains this type of tissue (the pyramidal cells) in much greater abundance than the human brain.' Dr. Herbert C. Major has given an instructive account of the histology of the brain of the Chacma Baboon in the 'Journal of Mental Science,' Jan. 1876, and refers therein to Meynert's memoir, l. c.

As regards the connexion of the occipital lobes with mental functions, it is well known that Neumann (cit. Cruveilhier, 'Anat. Descript.' ed. 1836, iv. p. 668; Longet, 'Système Nerveux,' i. 691, and 'Traité de Physiologie,' 1869, iii. p. 444) was induced from his examination of the brains of some fifty insane persons to hold that intelligence had its seat in the occipital lobes; and Cruveilhier is also quoted as speaking in the same sense ('Anat. Descript.' l.c., and 2de éd., Paris, 1845, tom. iv. p. 346) from having noticed that in senile dementia the occipital lobes are much more atrophied than the frontal. These arguments, like so many in the same sphere, are amenable to the objection that the atrophy in question may be merely a concomitant change, correlated in the way of mal-nutrition with some other really causative change, without being itself the first term in the series of evils. It is however by no means necessary to shelter ourselves behind this suggestion, for few if any mental alienists would be found

the centre of the parietal eminence and parallel to the line of the lambdoid suture, and behind by that line itself, may, with the zone

to take this view at the present time. In the last edition indeed (1870, iii. 2, p. 454) of Cruveilhier's 'Anatomie Descriptive' I find the words 'C'est sur ces circonvolutions occipitales que porte principalement l'atrophie sénile,' standing without note or comment or inference in connexion with them, and the reference to Neumann is omitted. But what is of much greater consequence is to find an authority with the vast experience which Dr. J. Crichton Browne possesses (see 'West Riding Lunatic Asylum Reports,' 1876, vol. vi. p. 218) averring that the exemption which the occipital lobes on his showing enjoy from the lesions characteristic of the general paralysis of the insane, is 'as it were only part of a wider immunity from visible pathological change' which they enjoy 'in all varieties of chronic insanity,' inclusive (p. 178) of 'senile, simple, and consecutive dementia.' Dr. Fox in like manner in his 'Pathological Anatomy of the Nervous Centres,' 1874, p. 41, tells us that 'the posterior lobes are less often affected than the middle, and hemorrhage there seems to be of far less serious import.' To these statements it may be well to add the following made by Professor Schröder van der Kolk ('Pathology and Therapeutics of Mental Diseases,' English translation by J. T. Rudall, Melbourne, 1869, p. 46), 'In insanity proper, in cases of confusion of ideas, and of haughty insanity, I have always found the anterior lobes of the brain suffering, but on the contrary in the melancholic and those who condemned themselves with or without religious admixture, I have found the upper and posterior parts of the lobes diseased, and that in the latter cases the understanding often showed no traces of disturbance, inasmuch as the individuals judged correctly and disputed acutely. The pathological affection limits itself then to the upper and hinder parts of the lobes, and in the fore parts nothing abnormal is seen in regard to colour, firmness, and connexion with the pia mater. In those who at last finished with dementia I never found the anterior parts of the lobes intact.' Cf. also pp. 24, 41, 44, 59, 63, 93, l. c.

Dr. Lelut, the author of a memoir 'Du développement du crâne dans ses rapports avec celui de l'intelligence,' published in the 'Gazette Médicale de Paris,' has been referred to by M. Foville ('Système Nerveux,' 1844, p. 649) and by Virchow ('Gesamm. Abhandlungen,' p. 916) as having shown that in the cases of idiots the greatest diminution of the skull takes place in the posterior part of its circumference. Neither of the authors who refer to M. Lelut accept this conclusion; and a reference to Professor Marshall's paper in the 'Philosophical Transactions' for 1864 (p. 543, pl. xxi, xxii, xxiii), 'On the Brain of a Bushwoman and on the Brains of two Idiots of European Descent,' will show that the facts upon which it is based may very readily be overstated, the real state of the case as regards the brains of these idiots being that 'whilst all parts have been more or less arrested, the frontal and occipital lobes have suffered more than the temporal or parietal.'

The comparative anatomy of the brains of men and apes shows that the occipital lobes have a greater relative development in the lower than in the higher apes, and it has been maintained by Dr. A. Pansch ('De Sulcis et Gyris in Cerebris simiarum et hominum,' 1866, p. 25; 'Archiv für Anthropologie,' 1869, iii. p. 252) that the 'operculum' which bounds the parieto-occipital fissure posteriorly is to be considered an upgrowth which is sometimes much diminished in the Anthropomorpha, and which is only rarely to be seen, except rudimentarily represented, in man. In other words, the external perpendicular or occipito-parietal fissure is a valley formed not by depression or excavation but by upheaval of cerebral substance, and this upheaval is less marked in the higher than in the lower Simiadae, and in Hominidae is usually entirely

of brain which has been shown to underlie it, be taken as eminently distinctive, according to its lesser or greater width, of the brachycephalic and dolichocephalic types of skull respectively.

As some difference is found in the statements of different writers as to the constancy, if not of the relations held by the supra-marginal lobule, to the parietal tuberosity, still of those of the parieto-occipital fissure to the lambdoid suture, it is well to say here that I have examined these relations as existing between the skull and the brain while *in situ*, and have measured the width of the zone in question in many brains removed from the skull. The ordinary width of this zone in the brains of the almost exclusively dolichocephalic population of this part of England is from 1·5″ to 2″; in such a skull, with a breadth-length index of ·76, having ascertained by boring that the centre of the supra-marginal lobule corresponded to the centre of the parietal eminence, I found that the distance from the former spot to the line of the parieto-occipital fissure was 2″ on both sides. In the brain of a Malay (No. '950

absent. As Gratiolet summed the matter up in his 'Mémoire sur les plis Cérébraux de l'Homme et des Primates,' 1854, p. 97, 'Le lobe occipital atteint le maximum de son développement dans les Cynocéphales. Beaucoup moins développé dans les Macaques il diminue de plus en plus en passant des Guenons aux Semnopithèques, et de ceux-ci aux Gibbons et aux Orangs-Ajoutons, et il atteint son minimum dans l'espèce humaine.'

As variability in a structure or organ is justly considered to be some sort of an indication that it is tending towards becoming rudimentary, the variability of the occipital portions of the skull and of the brain attains some significance. Of this variability I have already spoken, p. 246 supra. Since writing as above, a human brain has been added to the series in the University Museum (No. 950 g and h), the occipital lobes in which are remarkable for the extreme scantiness of their fissures and convolutions, the very reverse, extreme complexity, to wit, and sinuosity, being usually found in this part of the human brain, at least in Europeans, and being very ordinarily stated to be characteristic of it. See for example Cruveilhier's 'Anatomie Descriptive,' iii. 2. p. 454, ed. 4; Pansch, 'Abhandl. Naturwiss. Verein. Hamburg,' Altona 1876, p. 25; and Gratiolet's words applied to this lobe, 'Ses plis, d'une extrême irrégularité, semblent devoir échapper à toute description' (Mémoire, 1854, p. 61).

Taking all these considerations together, that namely of the inferiority of the hydraulic character of the vascular supply of the occipital lobes, that of their histological inferiority, that of their lesser amenability to disease, a privilege which we do not find to be enjoyed by organs of great functional importance, and that finally of their great variability, and coupling them with a comparison of the homologous lobes in the Simiadae, I am inclined to consider the occipital lobes proper of the human brain as being semi-rudimentary structures. A parallel case appears to me to be furnished by the history of the fourth (the azygos or post-caval) lobe of the right lung in the Primates. This small lobe retains its independent vascular and bronchial supply till we reach the higher Anthropomorpha; it is lost in them and in us.

i and j' in the Oxford University Museum), the skull belonging to which has not been accessible to me, but which may be supposed to have been brachycephalic, and from the measurements here given to have been sinistrally flattened (see p. 177 supra) in the parieto-occipital region, I find the width of this zone to be 0·95″ on the left and 1·7″ on the right side. In Negroes, who are usually spoken of as being 'occipitally dolichocephalic,' but in whom the position of the parietal tubera is more variable than in any other race of men with which I am acquainted, I have found the width of this zone to vary correspondingly. In one Negro brain I found it to be 2″ on both sides; in the cast of another, presented by R. Garner, Esq., F.L.S., to the University Museum, I find the width to be 2·3″ on the right side and 1·9″ on the left; in another, in which the posterior cerebral arteries on both sides were very largely contributed to by the carotids and the convolutions generally broad and coarse, I found the width of this belt of brain to be 0·4″ on the right and 1·1″ on the left side. It is rarer to find great differences in the width of this zone in dolichocephalic than in brachycephalic brains, which indeed the most superficial examination of the skulls would lead us to expect would be the case.

When, however, we have gained the knowledge that particular sets of convolutions in the brain underlie particular areas of the surface of the skull, and correspond generally in extent and limits with them, we have gained after all but little unless we can go further and show that particular functions, or at least that a greater power for activity in functions generally, can be assigned to the portions of brain thus localised. To attain either of these ends we must enter upon the following lines of enquiry. We must ask, firstly, whether any portions of the brain-surface have such a differentially advantageous blood-supply as to render it but reasonable to suppose that they have either differentially important functions, or a differentially greater amount of functions generally, to undertake. Secondly, we must discover whether the microscopical structure and connections of the several convolutions can be shown to differ in such a way and to such an extent as to justify us in conjecturing that important differences of function, either qualitative or quantitative, must be correlated with such differences of structure. Thirdly, we may learn much from observations as to the sequence of certain mental upon certain cerebral changes produced

either by disease or by accidents. Fourthly, the comparison of the brains of human beings of various known capabilities and ages with each other and with the brains of the lower animals which are nearest to man casts a diffused, if not a concentrated light upon the entire enquiry. Arguments bearing upon this question may be procurable from other sources; of the four specified the first furnishes us with the least ambiguous and the most readily verifiable indications; with these the indications furnished by the other three, if not connected in the way of effect with cause, are at all events correlated in the way of concomitant growth.

A survey of the distribution of the several arteries[1] supplying the cerebrum appears to show unmistakeably that the particular zone of convolutions in question is at unmistakeable disadvantage in the matter of irrigation as compared with the segments of the hemisphere which lie in front of it, and that of two brains of equal or approximately equal length that one is the more favourably conditioned which has this segment contributing the smaller factor towards making up its total length.

The belt of convolutions which interposes itself between the line of the lambdoid suture and another line drawn parallel to either half of that suture over the parietal tuberosity of that side receives its main arterial supply from the terminal twigs of that branch of the internal carotid which is known in this country as the 'middle cerebral' artery, but which for the present purpose might bear one of its foreign names, viz. 'arteria fossae Sylvii.' For it is only after having supplied the very numerous and extensive convolutions which form the floor and the walls and the margins of this great fossa that terminal branches of this artery emerge on to the exterior convex surface of the brain and distribute themselves to this

[1] Some difference of opinion exists between the two investigators, MM. Duret and Heubner, who have ('Archives de Physiologie Normale,' 1874, tom. vi., and 'Centralblatt für die Med. Wiss.' 1872, 'Die luetische Erkrankung der Hirnarterien,' 1874, pp. 172–175) been investigating the cerebral circulation, as to the degree of freedom with which the arteries in question anastomose with each other. Heubner however, who specially insists upon the formation in the pia mater of a common retiform reservoir by all the brain-supplying arteries in a common solidarity, nevertheless allows, as the facts of pathological embolism even more than those of experimental injection compel him, that the different parts of this reticulation are filled from the different main arteries with differing facility; 'von dem entfernteren natürlich schwerer und langsamer als von dem näheren.' This is all that need be asked for justifying the argument in the text.

zone of the hemisphere. In following up the distribution of the two terminal branches of the carotid we are impressed with the differentially favourable condition as regards vascular irrigation of the lower parts of the frontal lobes which receive supplies of blood from the anterior cerebral as well as from the middle cerebral arteries; the deep fissure of Rolando, though the convolutions bounding it may not be quite so advantageously supplied as the horizontal convolutions just spoken of, has nevertheless a double supply both from the middle and from the anterior cerebral artery; but it is from the middle cerebral artery alone that the area immediately posterior to and on the same level with the supra-marginal convolution, and this convolution itself, are supplied. When we consider the length and the direction relatively to the carotid of the fissure of Sylvius, the extent of the area to be supplied within it, and the tortuosities necessarily described by an artery passing along it to emerge on to the convex surface of the brain, in the words of Duret, l. c., the 'pli très accusé dans le sillon profond qui sépare le lobule de l'insula de la circonvolution marginale;' it is obvious to us that the current of the blood in the terminal arterial twigs supplying the part of the brain in question must be considerably slower than that in any portion of the brain situated anteriorly to it. This would be the case even with a system of tubes which were neither contractile nor elastic; that these properties of the arteries supplying this part of the brain may count for much is sometimes rendered strikingly plain to us by their embedding themselves in the substances of the cerebral cortex of brains preserved in chloride of zinc and alcohol. Several authors[1] have remarked upon the great variability of the cerebral convolutions in

[1] Bischoff, 'Die Grosshirnwindungen des Menschen,' Abhandl. bayer. Akad. der Wiss., cl. ii. bd. x. abth. ii. p. 432, S. A. 42; Ecker, 'The Convolutions of the Human Brain,' English translation by J. C. Galton, p. 33. In support of the view that great differences in functional activity may depend upon hydraulic differences such as those described in the text I may refer to the now usually accepted explanation of the phenomenon of right-handedness, to wit, the advantage which the left side of the brain obtains in the matter of irrigation by virtue of the origin of its carotid directly from the arch of the aorta. I take this opportunity of observing that the right cerebral hemisphere is very frequently put at a second disadvantage by the fact that the basilar artery gives it scarcely any supply at all, but distributes itself almost wholly to the left, leaving the carotid to give off the posterior cerebral artery of the opposite side. This arrangement I had noted previously to becoming acquainted with M. Duret's mention of it ('Archiv. de Phys.' 1874, p. 68). He does not connect it however with the hydraulic explanation of right-handedness.

the area of which we are treating; there are several reasons however for hesitation as to referring this variability of the topographical disposition of the vesicular neurine to the less vigorous character of the circulation of the blood in the arteries supplying it: but if this peculiarity does not explain the greater morphological variability of these convolutions, it does justify us in ascribing to them a lesser physiological activity.

Leaving now the consideration of the distribution of arteries over this particular area of the cerebral cortex as detectible by the naked eye, we come to a consideration of the histological characters of this zone as compared with that of the fronto-parietal convolutions which lie anteriorly to it. And it is a fact of cardinal importance that it is in this anteriorly situated part of the brain that the large pyramidal cells, the 'cornu ammonis formation' of Meynert, so characteristic of the healthy human brain, are chiefly, if not exclusively, found. The largest indeed of these pyramidal cells, 'Riesenpyramiden,' have been said by Professor Betz to be limited in their distribution posteriorly by the line of the fissure of Rolando (see 'Centralblatt Med. Wiss.' 1874), and Dr. Achille Foville ('Medical Examiner,' Feb. 1, 1877, p. 85) does but extend the area in which they are all but exclusively to be found, just so much further back as is the second ascending central convolution which forms the posterior boundary of that fissure. Dr. Major ('Journal of Mental Science,' Jan. 1876) has justly insisted upon the indications with which human pathology firstly, as shown by him in the 'West Riding Asylum Reports,' 1872, vol. ii. pp. 41–52, and comparative anatomy secondly, furnish us as to the functional importance of these pyramidal cells; it being in these cells that 'degenerative changes first occur when age is beginning to do its work and *pari passu* the intellect is failing,' whilst 'as we proceed downwards in the scale of development it is these cells which vary most distinctly from the corresponding bodies in the human organ.' To this I would add that the histological characters of these cells when compared with those of other cells known to discharge important functions with great activity are such as to vindicate their claim to a high rank amongst such cells. As seen in a microscopic specimen prepared by the ordinary reagents, these cells are remarkable, firstly, for their large size; then for their freedom from the limitation of a cell wall; thirdly for the clear lacunar spaces

in which they lie; fourthly, for their angular nucleolated nucleus prolonged at its angles into processes somewhat like those of the cell itself; fifthly, for these processes themselves, apical, basal, and lateral. Those who are impressed with the value of the hypothesis put forward by the late Professor Parkes[1] to the effect that in a living body activity of function entails certain processes of growth, whilst in rest the temporarily enlarged organ returns slowly to its normal size, will be inclined to consider the clear lacunar space which surrounds these large cells as eminently significant of their activity as allowing room for increase of their dimensions. Nor will any dispute as to whether these lacunar spaces are *arte facta* due to action of hardening and contracting reagents or natural, whether lymphatic or non-lymphatic, spaces affect this view. For the contraction which, on the former of these views, the cell undergoes in histological preparation may be very well taken as reproducing after death a similar contraction which, *ex hypothesi*, would accompany rest and abeyance of function in life.

Coming in the third place to a consideration of the evidence which processes of disease or other injury may give us for the conclusion that the parts of the brain anterior to the plane of the parietal tubera are more active and important in function than those situated posteriorly to it, I would refer the reader to the instructive Plates iii–viii given by Dr. J. Crichton Browne in his most valuable paper, already referred to, in the 'West Riding Asylum Reports,' vol. vi. 1876, on the pathology of the general paralysis of the insane. In those plates a number of brains from such patients are figured, and so coloured as to indicate the regions of the brain upon which the stress of the disease has fallen. *There is in these plates scarcely an instance in which a single patch of colour is given on a spot situated posteriorly to the fissure of Rolando.* And I submit that as it is but reasonable to suppose that the parts of any organ which are found to be the most liable to

[1] 'Proceedings of the Royal Society,' June 20, 1867, xvi. 94. Dr. Parkes having discovered that though active exercise produced no *immediate* increase in the elimination of nitrogen, such increase did nevertheless take place when a certain interval had elapsed after such exercise, explained (p. 55, l. c.) this succession of phenomena by suggesting that 'during action a muscle takes nitrogen and during rest gives it off,' or that, 'in other words, the action of a muscle would seem from these experiments not to be connected with disintegration but with formation; when it is in exercise the muscle increases, when it is quiescent it lessens in bulk.'

suffer from irritation, inflammation, and other morbid action are so because normally they are the seats of habitual activity, this distribution of the signs of disease over the area in question is of cardinal significance.

In the last place, I will mention very briefly the indications which the comparative anatomy of some of the various races of mankind, and of the developing skull and brain in the human species, as also the proportion of two segments of the parietal bone anterior and posterior to the line of the primitive centre of ossification, furnish to us in this investigation.

The most typically dolichocephalic modern race, not even excluding the Esquimaux, is beyond doubt the Australian. As was pointed out long ago in the 'Osteological Catalogue of the Royal College of Surgeons,' vol. ii. p. 838, No. 5385, brachycephalic skulls are to be found amongst Negro tribes, and (see p. 269 supra) instances may be found among Negro brains of excessive narrowness in the zone of brain between the supra-marginal and the occipital convolutions, though some of the most forwardly placed parietal tubera which I have ever met with are from series of Caffre crania; and though, secondly, these tubera are sometimes backwardly placed even in dolichocephalic Negro heads. Confining ourselves therefore to the consideration of the Australian cranium, which furnishes us with a simple case, as its uniformity and also the degraded character of the race are alike beyond dispute, we have to say that the parietal eminences all but always occupy a relatively forward position in the parietal bone and in the skull of the Australians; and that to the unvarying dolichocephaly of their brain the segments lying posteriorly to the plane of the 'lobulus tuberis' always contribute a quantitatively large though not a quantitatively superior proportion. Without going further into the controversy alluded to at pp. 244, 245 supra, as to the relative superiority of the dolichocephalic or brachycephalic type, it may suffice to say here that not only would the inferiorly irrigated and histologically inferior segments of the modern European dolichocephali found in Germany, England, and Ireland form a smaller proportion of the entire length of their brains than, judging from their skulls or from such casts as those labelled 6 and 7 in the Museum of the College of Surgeons, the homologous segments do in the Australian brain, but that the anterior segments of the European brain are broader, with their

fissures therefore deeper, and their aggregate square area of gray matter much more extensive than those of the Australian brain; the Europeans specified being dolichocephali latiores, and the Australians dolichocephali angustiores. But the dolichocephalic 'Silurian' type which characterised the inhabitants of Great Britain and Ireland, and of a very great part of Europe also, in the stone age, included crania resembling the Australian in the points of which we are speaking, for the long-barrow-builders were not rarely 'dolichocephali angustiores[1].'

[1] If Schröder van der Kolk's calculation as to the extent of that difficultly measureable area made up by the surface of the convolutions within and without the fissures from the fissure of Rolando to the front of the brain in men of various degrees of intelligence had been accepted and confirmed by other anatomists, another argument would have been available under this head. According to these calculations ('Pathology and Therapeutics of Mental Diseases,' Australian translation by J. T. Rudall, 1869, preface, p. vi), based upon measurements of the figures given by Rudolph Wagner in the first part of his 'Vorstudien zu einer wissenschaftlichen Morphologie und Physiologie des menschlichen Gehirns als Seelenorgan,' 1860, the 'lobus anterior before the gyrus centralis' held to the 'lobus anterior behind the gyrus' the relation,

in the mathematician Gauss . . of 88·5 : 100.
in the mathematician Lejeune Dirichlet of 100 : 100.
in the philologist Hermann . . of 75 : 100.
in the artisan Krebs . . . . of 69 : 100.

Schröder van der Kolk in writing to this effect, Nov. 21, 1861, to Dr. Theile of Weimar, l. c., remarks that 'it will be understood that this gives only a relative value and a relative accuracy, for I measure the plane and not the arched surface, but after all that occurs in a tolerably equal degree in all the measured brains. I am convinced it would lead to good results if comparisons were made in this way between the brains of persons of talent and those of less mental capacity.' But Rudolph Wagner, to whom the actual brains were available, whilst Schröder van der Kolk's estimate was based merely upon Wagner's figures of them given in his 'Vorstudien' of 1862, repudiated ('Vorstudien,' 1862, ii. p. 21) the Dutch anatomist's conclusions. And Hermann Wagner, following up mathematically his father's researches in his 'Maassbestimmungen der Oberfläche des grossen Gehirns,' 1864, p. 36, averred that the only difference which his more exact method of measurement, as applied to the difficultly measureable area in question, in four brains examined by him, including those of Gauss and Krebs, had enabled him to discover was that with the increase of intelligence the complexity of the convolutions increased in the frontal, but not demonstrably in the other lobes of the brain: 'Ein Bevorzugen eines einzelnen Lappens und zwar des Stirnlappens gegenüber dem ganzen Gehirn hat sich für die intelligenten Gehirne aber doch durch diese Messungen herausgestellt; die Oberfläche des Stirnlappens derselben besetzt eine stärkere Zerklüftung als die übrigen Lappen.' It is obvious, I may remark, that any argument which could be based upon mere mensuration of the square area made up by the convolutionary sheet of gray matter in various segments of the brain would be more amenable than any of the lines of argument given in the text to objections on the ground that such measurements took no account of possible variations in the thickness firstly, and in the quality secondly, of the sheet of gray matter.

The argument from the history of the growth of the skull which comes under this head cannot be given better than in the following words of Gratiolet ('Bull. Soc. Anthrop. Paris,' tom. ii. Avril 18, 1861, p. 253): 'Chez l'enfant nouveau-né le centre du point primitif d'ossification du pariétal est plus distant de l'extrémité occipitale du crâne que de son extrémité frontale. Le cas inverse est réalisé dans l'adulte. On déduit de ces faits une conséquence rigoureuse, savoir que dans le passage de l'enfance à l'âge adulte les parties antérieures du cerveau s'accroissent plus rapidement que les parties postérieures. Cet accroissement marche d'arrière en avant de l'occipital au frontal, il se propage comme une ondulation d'une vertèbre à l'autre.'

The maintenance therefore by the part of the parietal posterior to its tuberosity, a part representing its primitive centre, of a proportion at all approaching equality with the part anterior to it is a retention of infantile proportions, and *pro tanto* a sign of inferiority.

Mutatis mutandis a comparison of the skulls of the anthropomorpha leads us to a similar conclusion. In those apes, though the lobule of the marginal convolution and the parietal eminence corresponding to it are only faintly marked; and though the Asiatic Orang is often less dolichocephalous than its African allies; still the primitive centre of ossification of the parietal bone which may be supposed to hold the same relation to the subjacent brain which the homologous area in the human skull is wont to do, divides the bone, in all of these Simiadae, into two much more nearly equal segments than is usually the case in the adult human subject.

Thus from the four points of view furnished by considering their irrigation, their histological structure, their relative activity as indicated by their greater amenability to the incidence of disease, and their comparative anatomy, the anterior parts of the brain of which we have been treating can be shown to be superior in importance to those which lie posteriorly to them. The convolutions which are curtailed in the posterior part of a brain with its anterior segments relatively large are those which underlie that zone of the skull which is interposed between parallel lines drawn over the parietal tuberosity and over the line of the lambdoid suture. Hence the importance of the two craniographical

peculiarities, viz. the posterior position of the parietal tubera (p. 234 supra) and the vertical dip of the posterior half of the bone (p. 235 supra ibique citata) so characteristic of the brachycephalic skull, and so clearly indicative of a brain, *pro tanto* and *ceteris paribus*, favourably conditioned and advantageously constituted. And the rationale of a third craniographical distinction, that, namely, which is given in the 'Antero-posterior Index' (p. 167 supra), lies in its furnishing us with a more or less exact numerical expression of the relative extent of the more favourably conditioned segments of such brains. The average antero-posterior index of the dolichocephalic skull as obtained from the measurements, given with the descriptions, of the small number of 'Silurian' skulls figured in Section XV. of this volume, is 47 as against 52 for the average of the brachycephalic 'Cimbric' skulls, also figured here; and this disadvantageous proportion is only reduced by a fraction amounting to $\frac{1}{6}$ when we compare the average obtained from six other prehistoric Silurian skulls not figured in this book with the average obtained from six other brachycephalic skulls taken from Swiss, English, and Tamil series. These figures may be taken as being strongly confirmatory of the other evidence for the inferiority of the Silurian dolichocephalic to the Cimbric brachycephalic race which is furnished by several other physical peculiarities (see p. 238 seqq. supra and p. 279 infra), as well as by the historical or rather prehistorical fact of its having been conquered and in some parts of this country displaced and replaced by the later stock.

To obtain, however, a complete idea of the characteristics of a people, it is necessary not only to know what their stature and what the proportions of their skull measurements may have been, both in themselves and in relation to the brain-segments they covered; but to be able to reproduce to our view their complexion and the colour of their eyes. These latter points indeed, of which the barrows can tell us nothing, are to the ordinary traveller an enquiry at least as interesting as even the stature, and though it is possible to overrate their value and importance to the ethnologist, at all events when he is dealing with races as capable of complete fusion as those whose remains we are here concerned with, they still possess, even for him, an interest which is little inferior to that of the less perishable remains.

In Europe at the present day we have the following combinations

of complexion and stature and cranial indices. We have, firstly, in certain parts of Great Britain and of Germany light hair and complexion combined with considerable stature and with dolichocephaly, so as to preserve for us what excavations, combined with measurements and with traditions, justify us very entirely in speaking of as the Teutonic or Germanic type[1]. Secondly, we have the same hair, complexion, and stature combined with brachycephaly in the Finns[2], in the Danes[3], in some Sclavs, and in many of not the least vigorous of our own countrymen. Thirdly, hair, complexion, and stature, all alike of just the opposite character, may be found combined with brachycephaly in South Germany, and in some other parts of the Continent, as, for example, Brittany[4]. Fourthly, and as regards the earlier of

[1] See Hölder, 'Archiv für Anthrop.' ii. p. 51; v. p. 538; 'Zusammenstellung der in Würtemberg vorkommenden Schädelformen,' 1876, p. 6; and Cleland, 'Phil. Trans.' 1870, p. 148.

[2] Virchow, 'Beiträge zur physischen Anthropologie der Deutschen,' 1876, pp. 9, 10; 'Zeitschrift für Ethnologie,' iv. 380, v. 320; 'Archiv für Anthropologie,' iii. 553–555, iv. 78.

[3] Dr. Beddoe, 'Mem. Soc. Anth. Lond.' vol. iii. p. 382.

[4] Hölder, 'Zusammenstellung,' p. 6, says, 'Aus dieser Zusammenstellung geht nun mit Sicherheit hervor dass Haare und Augen um so heller werden je näher der Index des Germanischen Typus kommt, und desto dünkler je brachycephaler der Schädel ist. Blaue und graue Augen und blonde oder hellbraune Haare so wohl hier als in Waiblingen häufiger mit hoher Statur vorkommen als dunkle Augen und Haare. Der Hauptmasse der letzteren fällt nämlich auf die grossen Classe von 166–176 cm. (=65·35″–69·29″); zwischen 176 und 182 cm. (=69·29″–71·6″) fanden sich nur blaue und graue Augen und der grösste von ihnem mit 182 cm. war blond und blauäugig.' Ecker ('Archiv für Anthropologie,' ix. 1877, p. 259) says, writing from Freiburg im Breisgau, 'Die in unserem Lande einst so verbreitete Schädelform der Reihengräber die wohl unzweifelhaft auch mit einer bestimmtere Körperstatur verbunden war, jetzt fast ganz einer anderen Form Platz gemacht hat deren Träger in ihrem ganzem physischem Habitus anders geartet sind als jene es wahrscheinlich waren. Waren jene hoch gewachsen vorherrschend blond so sind diese gedrungener dünkler vom Haar und Augen.' Of the Bretons, Dr. Beddoe ('Memoirs Lond. Anth. Society,' iii. p. 362) says they are of low stature, being remarkable for this even among the French, that in about three-fourths of the people the hair is very dark, and in about one-fourth coal-black, and that the head is, as Broca had pointed out, short and broad, with the exception of the Léonois district. Broca, writing of Bretons (see 'Mém. Soc. Anth. Paris,' i. 1859, or 'Mémoires d'Anthropologie,' i. p. 297; and 'Bull. Soc. Anth. Paris,' Ser. ii. tom. viii. p. 313, Avril 1873), contrasts the Celtes *s.* Armoricains, being petits, bruns, brachycéphales, with the peuples Belges *s.* Kymrys, who are grands, blonds, dolichocéphales. Sir Henry Dryden, Bart., writes to me of the Bretons to the following effect:—'As compared with the English the whole race are brachycephalic, but the Breton peasantry much less so than the middle class. The Bretons are taller than the other French. I noticed in the regiments many very short small men, and I

the two prehistoric races with which we are dealing, most importantly, we have in this country dolichocephaly combined with low stature and with dark complexion in a very considerable number of our population, even in districts such as the Midland Counties, where the names of the towns and villages show that the Saxon and Danish conquerors occupied it in for the time entirely overwhelming numbers. The fact of the existence of this stock, or, we may perhaps say, of its survival and its re-assertion of its own distinctive character in the districts of Derby, Stamford, Leicester, and Loughborough, was pointed out in the year 1848 by the late Professor Phillips, at a meeting of the British Association at Swansea (see Report, p. 99). More extended observations, but to the same effect, are put on record by Dr. Beddoe ('Mem. Soc. Anth. London,' ii. p. 350) in the following words: 'Of twenty-five Englishmen having black or brownish-black hair, the average index of head-breadth is so small as 76·5, which is the lowest I have met with in any set of men. Eight Welshmen having black hair yielded the same modulus to a fraction as thirty-eight who had hair of other colours, though I must concede that eight black-haired Kerrymen had heads broader by ½ per cent. than twenty-four others. The observations of my friend Mr. Hector Maclean on the islanders of Islay and Colonsay bear me out on this point very strongly, his black-haired men, twenty in number, yielding a modulus of seventy-six, or 3 per cent. less than that of their lighter-haired neighbours. *Mr. Maclean's measurements and my own both indicate that a notable, though not very great inferiority in stature and bulk, does, on the average, characterise the black-haired type.*'

The tall, powerfully-made brachycephalous Briton of the round-barrow period all but certainly presented much the same combination of physical peculiarities as the modern Finn and Dane, whilst of the feebler folk of the long-barrow times we may say with nearly equal probability that they possessed, like the modern English, Irish, Scotch, and Italian of similarly low stature, the 'colorati vultus' ascribed by Tacitus to the Silures, and supposed by him to furnish some ground for connecting them with the Spanish.

think almost all the swarthy men were small. Many were very swarthy. Many of the middle class not Bretons are ludicrously brachycephalic, and their necks often thicker than most English besides.'

The indications in favour of these views are as follows. The bronze-period Briton very closely resembles in his osteological remains the brachycephalous Dane of the neolithic period, and the likeness between these and some of the modern Danes has been noticed by Virchow in his valuable Memoir on 'Die altnordischen Schädel zu Kopenhagen,' 'Arch. für Anth.' iv. p. 71, 1870. There are not wanting, as already pointed out, p. 227 supra, reasons for supposing that the brachycephalic people of the round-barrow period may have immigrated into this country from the Cimbric Peninsula[1], that, in other words, the historical invasions of Cnut and Swegen may have been but repetitions of prehistoric invasions of the bronze period, of, in other words, earlier 'Wikingzüge.' This being so, it becomes of consequence to recollect that though the ancients, the contemporaries of the Cimbric invaders, differ as to speaking of them as 'Gauls' or 'Germans,' they are unanimous as to describing them as light-haired and blue-eyed, as well as tall of stature, in comparison at least with the Italian population, Horace's line, 'Nec fera caerulea domuit Germania pube' (Epod. xvi. 7), being supported by parallel[2] passages nearly infinite in multitude.

[1] Of the modern Danes we know from Dr. Beddoe's paper in the 'Memoirs of the Anthropological Society,' vol. iii. p. 382, that with the cephalic index of 80·5 they combine a stature of 5′ 6·9″, which would be a fair average for Great Britain, eyes which are almost always light and either blue or bluish-grey, and hair which is generally either pale yellow or light brown. It would be interesting to know whether in the exceptional cases, in which the hair is black, as in the Moen man of whom Dr. Beddoe writes, the colour was not light in infancy; this change being one which is often observable amongst us now, as indeed it was among the Gauls in the time of Strabo and Diodorus Siculus (and, as Mr. A. J. Evans informs me, among both the Finns and the Lapps), and being one which, upon the principles of modern zoology, should be taken to indicate that the parent stock was originally light-haired permanently. The words of Diodorus Siculus (v. 32) are—*τὰ παιδία παρὰ τοῖς Γαλάταις ἐκ γενετῆς ὑπάρχει πολιὰ κατὰ τὸ πλεῖστον· προβαίνοντες δὲ ταῖς ἡλικίαις εἰς τὸ τῶν πατέρων χρῶμα ταῖς χροαῖς μετασχηματίζονται.* I should doubt, even as to the earlier race, whether Jornandes, when he, in the words of Lipsius, 'adspexit imo transcripsit' the chapter xi. of Tacitus' 'Agricola' relating to the Silures, had any real reason for substituting 'torto plerique crine et nigro *nascuntur*' for the exact words of the great historian.

[2] For these see Ukert's 'Germania,' pp. 198, 199, 345, 347, 348, 353, 362; Zeuss, 'Die Deutschen,' p. 51; Périer, 'Fragments Ethnologiques,' pp. 43–82; Prichard, 'Physical History,' iii. 3rd ed. 1841, pp. 189–200. The Chevalier Bunsen is referred to by Prichard as saying that he had 'often looked in vain for the auburn or golden locks and the light caerulean eyes of the old Germans, and never verified the picture given by the ancients of his countrymen till he visited Scandinavia, and that there he found himself surrounded with the Germans of Tacitus.' Exact investigation has

I have already remarked, pp. 224, 225 supra, that intermediate forms, belonging distinctively to neither the one nor the other of the two great types of dolichocephaly or brachycephaly, are not common in these series. In the skulls of the stone age in Great Britain we find no unambiguous traces at all of any admixture with the brachycephalic type; and even amongst skulls from barrows of the bronze age, when the two races were living and dying together, it is rare to find skulls which combine, as the 'Mischformen' of the German anthropologists do, the contour and picturesque peculiarities of the one type with the proportions and measurements of the other. Still such forms are to be found, and there are two principal varieties of skull from the later period, the existence of which is perhaps better explained by the hypothesis of their being the result of intercrossing than in any other way. And, firstly, I should be inclined to consider the very large size[1] of certain crania of the bronze period as due to an

however recently shown (see Virchow, p. 11, 'Beiträge zur physischen Anthropologie der Deutschen,' 1876, Berlin Abhandlungen) that the physical characteristics of light hair, blue eyes, light skin, so constantly spoken of by the ancient writers, make up still no less than 35·47 per cent. of the children at school in Prussia, though the proportion falls to 20·36 per cent. in Bavaria, brunettes being in this latter country 21·09 per cent. against 11·63 in Prussia.

[1] Without extending our view to the lower animals, it is easy to convince ourselves that a great increase of size is very often at the present day a result of the intercrossing of two varieties of our own species. Von Baer, on the occasion of the famous meeting of anthropologists at Göttingen in 1861 (see 'Zusammenkunft einiger Anthropologen,' p. 22), drew attention to the increase of vigour which Baron Osten Sacken had observed amongst North American half-breeds; and Professor Daniel Wilson, in his 'Memoirs on Hybridity,' p. 27, 1875, writes with great particularity to the same effect in the following words: 'The Half-breeds are a large and robust race, with greater powers of endurance than the native Indian. Mr. S. J. Dawson, of the Red River Exploring Expedition, speaks of the French Half-breeds as a gigantic race as compared with the French Canadians of Lower Canada. Professor Hind refers in equally strong language to their great physical powers and vigorous muscular development; and the Venerable Archdeacon Hunter, of Red River, replies in answer to my inquiry, "In what respects do the Half-breed Indians differ from the pure Indians as to habits of life, courage, strength, increase of numbers, &c.?" "They are superior in every respect, both mentally and physically." Much concurrent evidence points to the fact that the families descended from mixed parentage are larger than those of the whites; and though the results are in some degree counteracted by a tendency to consumption, yet it does not amount to such a source of diminution on the whole as to interfere with their steady numerical increase.' Similarly, Mr. Huth ('Marriage of near Kin,' 1875) writes, p. 308, 'that crosses are beneficial in very often effecting an increase of size in the progeny, exceeding that of either parent, is established beyond doubt.' Pp. 324 and 325; 'The Zamboes, or offspring of Negroes and American

intercrossing of the two stocks. Such skulls are all found in barrows of the later period, and all, while retaining both the contour and the proportions of the brachycephalic type, still exceed the great majority of such skulls in the matter of cubical capacity. His and Rütimeyer consider the largest of the skulls treated of by them in their 'Crania Helvetica' (p. 44), skulls to wit with an average capacity of 1638 cc.=circa 100 cub. in., a maximum of 1820 cc.= circa 111 cub. in., and a minimum of 1430 cc.=87·27 cub. in., to be the result of the intercrossing of their 'Sion typus,' which is the skull of the 'Pfahlbauten' and (p. 34) 'unserer Keltischer Vorfahren' and corresponds to many of our long-barrow skulls, with their 'Disentis Typus,' which corresponds to many of our round-barrow skulls. It is of great importance to note this coincidence as to the facts observable in Switzerland and in Great Britain respectively.

A second variety of skull, which I incline to consider a 'Mischform,' is found in round barrows containing both dolichocephalic and brachycephalic crania, lying together peacefully and in equally honourable positions within their precincts. These skulls differ from those just spoken of in being dolichocephalic by measurement, but they resemble them in combining with this proportion of breadth to length the precipitous dip downwards of the posterior half of the parietals which is so characteristic of brachycephaly generally, and the great height which is so characteristic of the brachycephaly of prehistoric times. A skull figured by Dr. Ad. Pansch ('Arch. für Anth.' vi. 3, p. 175, 1873) as found in a deposit cut into in the excavations for the new harbour at Kiel and in surroundings which, without definitely proving the skull to have belonged to the stone age (pp. 174, 179), did yet vindicate for it claims to a very considerable antiquity, gives a very good representation of this form of skull. Another may be found in the ancient British skull from a barrow at Kennet, near Abury, North Wilts, figured and

Indians, are, according to Dr. Hancock, remarkable for their physical superiority over their progenitors on either side, and this he says is a well-known fact.' *Per contra*, 'Most of the criminals of Nicaragua are, according to Squier, Zamboes, bigger and better made than their parents, without possessing any of their good qualities.' Dr. Beddoe's investigations into the stature and bulk of man in the British Islands ('Mem. Anth. Soc.' iii. 553) have led him to say, 'on the whole, the results of my tables tend to support, but only in a feeble way, the current opinion as to the advantageous effect of crossing upon size.' Professor Broca ('Mémoires,' i. p. 342) says, 'L'amélioration des races par des croisements est fortement contestée aujourdhui;' but he should have added, I think, words limiting the dispute to France.

described in the 'Crania Britannica,' Pl. 11, by Dr. Thurnam. Some additional probability for the view which would consider these skulls to be 'Mischformen' is on the principle laid down in note 4, p. 232 supra, gained from the fact that this latter skull had belonged to a skeleton with a thigh of 20·5″, and by consequence to a man of not less than 6′ 2″ in stature. Neither of the authors touch upon this point in treating of these skulls; they coincide with each other in observing upon the great height and the vertical dip of the posterior part of their parietals. As regards the series of prehistoric crania with which I am dealing, I have to say that whilst skulls of this kind are by no means rare in interments of the bronze period (e. g. 'Flixton, lxxi. 12,' p. 278; 'Jarrett, civ.' p. 315; 'Sherburn Wold Prodham, ix. 1;' 'Paulinus, cxiii. 3,' p. 322), they form a considerable proportion of the skulls from Canon Greenwell's series of the late Keltic or early iron age of Great Britain, and are entirely wanting, so far as I have observed, in the series from the long barrows. The skull from Grimthorpe in the East Riding of Yorkshire, described in the Proceedings of the Society of Antiquaries, March 18, 1869, by Dr. Barnard Davis, and now in the Oxford University Museum; the skull from Arras in the same locality, figured and described by Dr. Thurnam in the 'Crania Britannica,' Pl. 6; and a skull from Crosby Garrett (see p. 386 of 'British Barrows') in the county of Westmoreland, may be mentioned as combining the peculiarities above spoken of with the archaeological surroundings of the comparatively short period between probably, at the utmost, 200 B.C. and 100 A.D. Mere etymology might lead a reader to suppose these lofty yet dolichocephalic skulls might resemble the 'Hypsistenocephali' of the Melanesian islands described by Dr. Barnard Davis (locc. citt. supra, p. 246), they differ however from these skulls in being larger in cubical contents; in being better filled out, especially in the frontal region; in being orthognathous; and above all, in having their parietal tubera far more backwardly placed. See p. 454 of 'British Barrows.'

I will now pass from the consideration of the skulls as found in a more or less perfect condition, or at least in one which has admitted of their being, partially at least, restored, to a consideration of certain conclusions which have been based upon the appearances presented by the fragments into which the prehistoric skulls are, so often and so unfortunately, found to be broken.

Dr. Thurnam has in several memoirs[1] argued from the appearances presented by the breakages observable in the skulls from long barrows to the existence of the practice of human sacrifice upon the occasion of the interment of the chiefs in the stone age. We have a large mass of literary evidence in favour of the continuation of this practice into historical times amongst the Gauls and other foreign races with whom the Romans and Greeks came into contact. The story of the funeral of Patroclus preserves for us a tradition of its existence amongst the Greeks themselves; and from Virgil's allusions ('Aeneid,' x. 518–520, xi. 81, 82) and Tertullian's suggestion ('De Spectaculis,' xii) as to the origination of

[1] As regards the literature of the supposed discovery of skulls cleft *ante mortem*, the following references may be given :—

Mr. Cunnington in 1801 ('Ancient Wilts,' Sir R. C. Hoare, i. 87, cit. Thurnam, 'Archaeologia,' xxxviii. p. 420) found in a long barrow near Heytesbury, called Bowl's Barrow, a number of skeletons crowded together at the east end, the skull of one of which appeared to have been cut in two by a sword.

Sir R. C. Hoare writing in 1817, 'Archaeologia,' xix. p. 48, says, 'Only one or two instances have occurred where we have found any defect or pressure on the skull, indicating a mortal wound: but in one of the barrows near Stonehenge, we dug up a skull which appeared to have been cut in two by some very sharp instrument, and as nicely as any instrument of Savigny could have effected. This skull was reinterred in the same barrow.' A Round Barrow, Tumulus 36, 'Ancient Wilts,' p. 163.

Dr. Thurnam, writing in 1855 in the 'Crania Britannica,' pl. 24, Littleton Drew, says (p. 3) of the fragments of a skull, that 'the fractured edges were very sharp, suggesting the idea of having been cleft during life.' Writing in the 'Archaeologia,' xxxviii. 18[6]0, of the long barrow at West Kennet, Wiltshire, Dr. Thurnam dwelt at greater length upon this subject, saying that the occurrence of such cleft skulls was curious and had 'an important bearing on the estimate to be formed of the general grade of civilisation of those who must be regarded as our remote ancestors.' His views were still further developed in the 'Memoirs of the London Anthropological Society,' 1865, as also in the 'Journal of the Archaeological Institute' of the same year, vol. xxii. p. 107, in which he describes the appearances presented by the Ebberston skulls now in the Museum of this University. In the 'Crania Britannica,' pl. 59, Dr. Thurnam, in his account of the skulls from the chambered long barrow at Rodmarton in Gloucestershire, examined by Canon Lysons in 1863 (see 'Proc. Soc. Ant.,' N. S. ii. p. 275, or his work, 'Our British Ancestors,' p. 137, 1865), describes and figures from that barrow a skull now in this Museum as an example of a skull cleft *ante mortem;* remarking (p. 4, note) that another of these supposed cleft skulls, from West Kennet, was like the Rodmarton specimen in having the frontal suture open, whilst the uninjured skulls were of a considerably more elongate type. Finally, in the 'Archaeologia' for 1869, vol. 42, pp. 185–188, we have the evidence as to human sacrifices restated with many references, and we have also appended to it the allied subject of anthropophagism; at p. 227 we have the Rodmarton skull, now before me as I write, figured; and the author states that the chambered barrows of Nympsfield and Charlton Abbots are the only instances of such barrows examined by him in which traces of violent cleavage of cranial bones had not been found.

gladiatorial shows from the sacrificing of men at funerals, we know that the Italian races were at one time guilty of the same cruelty. 'Necdum ea aetate,' says Heyne, Virg. l. c., 'metuendum fuit Maroni ne displiceret immane facinus lectoribus,' such sacrifices having been abolished, as Pliny (H. N. xxx. 3. 4) tells us, by the Romans, only in the year 97 B.C. Still, in spite of these familiar and a cloud of other testimonies[1] of the literary kind in favour

[1] As regards the literature of immolation at funerals, the following references may be given in addition to those given in the text:—

Herod. iv. 71, the words in which, *ἔπειτα ῥιψὶ καταστεγάζουσι· ἐν δὲ τῇ λοιπῇ εὐρυχωρίῃ τῆς θήκης, τῶν παλλακέων τε μίαν ἀποπνίξαντες θάπτουσι, κ.τ.λ.*, find a detailed illustration in Dr. Joseph Anderson's translation of Professor Holmboe's Danish version of the Arabic account by Ahmed Fozlan of the cremation of a Norse chief, 'Proc. Soc. Ant. Scot.,' May 13, 1872, especially p. 525. Dr. Joseph Anderson, l. c. p. 522, refers to the Volsunga Saga as giving an account of the erection of a tent by Brynhild Gunnar over the pile on which she was to be burnt with Sigurd's corpse. J. C. F. Baehr, vol. iv. p. 560 of his 1832 edition of Herodotus, supplies the following references from Clarke's 'Travels' in illustration of the account given by Herodotus of the funeral of a Scythian chief: i. pp. 32, 38, 199, 316, 338 coll., 354, 399, 432 seqq. I have not been able to verify these references, and they are omitted in Baehr's later edition, l. c. I owe to him however many of the following references bearing principally upon the practice of widow-immolation:—

Hdt. v. 5.
Cicero, Tusc. Disp. v. 27.
Diodorus Siculus, xvii. 91, and xix. 33, 34.
Strabo, xv. 1. 30. 699; xv. 1. 62. 714.
Propertius, iv. 12–15.
Nicolaus Damascenus, fragm. 143, 155–161; 3. 463.
Valerius Maximus, ii. 6.
Plutarch, ii. 499.
Mela, ii. 2; iii. 2.
Pausanias, iv. 2. 5.
Aelian, V. H., vii. 18.
Servius, fl. A.D. 390, ad Verg. Aen. vi. 228.
Theodoret, Or. ad Graecos, ix. p. 129.
Stephanus Byzantinus, s.v. *Γερία*.

With reference to this last-cited author it may be remarked that he makes no mention of any competition existing between the widows for the right of immolation on the occasion of the husband's death. To the fact, however, of such a competition existing we have the evidence, whatever it may be worth, of Herodotus v. 5, Cicero, Propertius, Diodorus, Strabo, Valerius Maximus, Nicolaus Damascenus, and Mela, locc. citt.

Grimm, 'Das Verbrennen der Leichen,' 'Kleinere Schriften,' p. 300, agrees with Strabo, xv. 1. 30, in considering as inadequate the reason reported or assigned by both Strabo and Diodorus, xvii. 91, for the origin of widow-burning, an institution for the establishment of which, as we know from Professor Max Müller, 'Chips from a German Workshop,' ii. 34, ibique citatis, it was necessary to falsify the Vedas. He does not say why he repudiates the reason mentioned by those two writers, *ὅτι ἐρῶσαί*

of the practice of human sacrifice having persisted in this part of the world into perfectly historical times, 'paullo supra hanc memoriam,' as Julius phrases it, 'Bell. Gall.' vi. 19, I have to say that the bones found in the long barrows of England do not seem to me to bear the interpretation which Dr. Thurnam has put upon them. Two of the sets of bones from long barrows which Dr. Thurnam has described as furnishing evidence which would 'convince the most incredulous,' those, to wit, from the Ebberston and those from the Rodmarton long barrows, are now in the Oxford University Museum, and I have compared them with a considerable number of skulls about the *ante mortem* character of the lesions on which, whether recovered from or not, there is no doubt whatever. Amongst these latter skulls I may specify a number of dried and prepared New Zealand 'heads' in the Oxford University Museum, and the skulls numbered 2880 A, 2880 B, 2880 C, and 2902 A in the Museum of the Royal College of Surgeons. By the kindness of Professor Humphry I was allowed to examine Dr. Thurnam's collection in the Anatomical Museum at Cambridge.

The first point in which the fractured portions of skulls known

ποτε τῶν νέων αἱ γυναῖκες ἀφίσταιντο τῶν ἀνδρῶν ἢ φαρμακεύοιεν αὐτούς, which however does not appear a wholly improbable one; nor, though he refers, p. 296 note, to Professor Max Müller's article, 'Zeitschrift der morgenl. Gesellschaft,' bd. ix. 1855, does he specially mention the fact of the falsification of the Vedas. It is less excusable that Grimm should have written of the practice of widow-burning, of which both Strabo and Diodorus had spoken with reprobation, in the following terms, p. 307:—

'Wie hat sich die oft gefühllose Weichherzigkeit der neueren Luft gemacht gegen den herben Brauch des Mitverbrennens der Frauen im Alterthum, und doch billigen wir, dass die Ehe, wenn sie ihres (Gesetzausdrückenden) Namens werth sei, ewig und unauflösbar heisze, und preisen als seltnes Glück, dass hoch-bejahrte Ehleute auf denselben Tag hingerafft werden. Denn erhebend ist es wenn gesagt werden konnte

'"Bis sex lustra tori nox mitis et ultima clausit,
Arserunt uno funera bino rogo."' Martial, 10. 71.

Further references may be found in the 'Antiquitates Danicae' of Thomas Bartholinus, 1689, who says, p. 556, 'pleni sunt Historicorum libri, varias apud nationes, uxores maritis superstites simul cum defunctis crematos, vel super corpora eorum interfectas.'

In a later work on Danish antiquities, Arnkiel's 'Cimbrischen Heyden-Religion,' 1702, four chapters, xv–xviii. pp. 97–135, are devoted to the four subjects of the burial of wives with their dead husbands, the burial of friends, the burial of captives, and the burial of slaves in honour of great men deceased.

Professor H. Schaaffhausen's article, 'Die Menschenfresserei und das Menschenopfer,' in the 'Archiv fur Anthropologie,' iv. 1870, p. 245, is the most recent and one of the most valuable memoirs upon this subject.

to have been fractured *ante mortem* contrast with several of those described by Dr. Thurnam is their great inferiority in mere number. The skull of a man whom we know to have been hewn down by a metal sabre, or to have been killed, as the New Zealanders are known to have been, by a stone axe, may have some two or three broken surfaces in its vault; in the skulls on which Dr. Thurnam bases his inferences 'the angular fragments are so numerous that one might suppose the gashes had been inflicted in sheer wantonness;' Cran. Brit., pl. 59[1].

Now I submit that the principle of least action is at least as likely to have regulated the proceedings of ancient as of modern manslayers, and that the very fact of these ancient skulls being broken into such a multitude of fragments, a comminution which would have entailed an amount of trouble as purposeless in the eyes of those who would have had to go through it as it is repulsive in ours, is a *prima facie* improbability of the very first magnitude against the interpretation in question.

Leaving purely quantitative considerations and coming to the character of the fractures in each of the two sets of skulls, I have in the second place to say that the broken surfaces in the skull fragments described by Dr. Thurnam are, in spite of the very considerable variety which is observable in skull-surfaces, howsoever and whensoever fractured, very different as a whole from those of skulls which we positively know to have been cut into and through

[1] A nearly equally valuable standard of comparison is furnished to us by the figures and description of chopped horses' bones given by Professor Engelhardt in his 'Denmark in the Early Iron Age,' pp. 70-71 (Eng. Trans. 1866). Of two of the skulls of these horses it is said that the incisions upon them are 'both deep and numerous,' one of them showing as many as six, the other as many as ten different cuts. The skulls from the long barrows are, unhappily for the interests of reconstruction, broken into much more numerous fragments; and Professor Steenstrup does not believe that the horse-bones in question were so cut while the animals were living, or had their flesh upon them; for 'a minutely-splintered fracture has been produced by the chip having been broken away from the bone by a vigorous twist of the sword, leaving a smooth sharply-cut surface; and this circumstance seems to indicate that these violent blows had been inflicted when the bones were no longer covered by flesh; for, if the flesh had still been on the bones, *these would probably have presented a more jagged or roughly splintered fracture.*' The words in italics relate to a state of things quite different from that quite correctly described by Dr. Thurnam ('Principal Forms of Ancient British and Gaulish Skulls,' 1865, p. 70) as presenting us with 'the edges of the divided bones perfectly sharp and clean, and the fragments themselves having a porcellaneous character.' The reference to Engelhardt's work I owe to John Evans, Esq., F.R.S.

during life or immediately after death. It is true that the cut surfaces described by Dr. Thurnam may have a 'clean' and 'porcellaneous' appearance; but in answer to this I have to say, firstly, that I have seen perfectly similar surfaces produced in the very old and altered skulls in question by accidental falls or impact or pressure; and that it was an occurrence of this kind happening in the case of a skull-bone from the cremation long barrow at Market Weighton which first opened my eyes to the questionableness of Dr. Thurnam's theory. But, secondly, the broken surfaces in the skulls from Ebberston and Rodmarton have both their tables broken in the same or very nearly the same plane, and though an incision of this kind can be effected in a living skull by a vertically delivered blow, as it is not rarely effected in a dead and buried skull by a spade, the immense majority of wounds which we find on skulls known to have been struck by sword or axe have been inflicted in the way of oblique impact, as proved by the prismatic chip of bone which they have forced up out of its proper relations. It is well known that it is common enough even for a well-directed thrust with 'that queen of weapons the bayonet' to be deflected into innocuous obliquity even by such a surface as that of a rib; much more then would a stone-weapon be liable to be deflected from the denser and more resistent surface of the more mobile skull. Hence if these prehistoric crania had really been battered by prehistoric weapons we should expect to find a very large proportion of obliquely received wounds upon them. Just the reverse of this is the case with the fragmentary skulls which Dr. Thurnam and I myself have obtained from the long barrows both of the cremation and the non-cremation kinds. Numerous as are the fragments into which these skulls are broken up, it is rare for the line of fracture to pass otherwise than vertically through both tables, or to leave the inner table either projecting beyond the plane of the broken surface of the outer one or broken away for a greater square area than that lamina. The appearance presented by an aggregate of such skull-fragments is not unlike the aggregate of fragments resulting from the discharge of a firearm, pistol or other, so close to the base of the skull as to subject its vault to the sudden and enormous tension resulting from the explosion of the gunpowder. The results of such an injury may be seen in the multitudinously fractured skull No. 2902 A in the Museum of the Royal College of

Surgeons of England, and will be found described at p. 64 of Mr. Heath's Jacksonian Prize Essay for 1867, published 1872. The instantaneous tension of the explosion may be seen in this case to have produced a great number of fragments with their broken surfaces even and vertical; but what such violent expansion produces momentarily on a tough skull, that, compression or other strain due to the settling of the soil, or indeed shock from disturbance in secondary burial, may very readily be understood to be competent to produce on a skull rendered fragile by the lapse of centuries. The Ebberston barrow and the Market Weighton barrow, in which these fractures have been noted, were both of them cremation-barrows, and the action of fire, even when as at Ebberston imperfect, would be distinctly in favour of making the bones more brittle; and in these and in the other barrows the great age of the interments, which are undoubtedly of premetallic times, may be taken in part-explanation of the loss of resistance testified to by these fractures. It is remarkable that Dr. Thurnam ('Cran. Brit.,' pl. 59) should have observed that 'the perfect skulls from these barrows, inferred to be those of chiefs, are of considerably more elongate type than those which are cleft,' and should have put on record the fact that two of his supposed cleft skulls should have had the frontal suture persistent and have possessed thus a broader and less dolichocephalic form, i.e. have been better filled and larger skulls 'than the rest.' For, as is well known[1] and may be readily verified, better filled and larger skulls differ from smaller ones in having thinner walls and being more fragile; and to this, and not to any such cause as their having been the skulls of 'serfs of less pure blood than their lords,' a view contra-indicated by their size (p. 237), we may reasonably refer the fact of a large proportion of the broken skulls being broader than the unbroken.

I have further to remark that fractured surfaces such as those described by Dr. Thurnam, and interpreted by him as indicating slaughter of victims at the funeral of a chief, may be and often are found in skulls of skeletons buried singly and in skulls buried with relics[2], provided that they have been subjected to pressure from the

[1] See Weisbach, 'Schädelform der Rumänen,' pp. 8, 12, 30.

[2] For example, the skull already spoken of at p. 196 as 'Rudstone, lxviii. 7,' had been broken into a very large number of fragments with even and vertical edges, and this though its walls were of great thickness. But with it the following relics

shifting of soil or the downward settling of stones upon them. The first effect of such agencies appears to be the forcing inwards of the basi-cranial bones, a process analogous to that which Dr. Barnard Davis has described as taking place in the senile living body, and which other writers have spoken of as 'impressio baseos cranii.' The second effect upon the vault of the skull thus deprived of its basal support may take either the direction of flattening out of the arch or that of compression of it from side to side. Those who are most familiar with the multiform and even grotesque shapes into which skulls thus crushed are distorted, and with the cleanness and sharpness and extent of the fissures, which pass sometimes more than half over their transverse arcs, will be slowest to accept Dr. Thurnam's interpretation of the fractured skulls in question. Until the fractures of which Dr. Thurnam has written are shown to me in a skull with its basi-cranial bones left, as they might be in a sacrificed victim, uninjured and *in situ*, I shall hesitate to refer them to the working of any but one of the two following *verae causae*, viz. (*a*) settling or sinking of the soil or stones in which the skulls have been laid; (*b*) the disturbance and violence necessitated by successive interments, and resulting, as has often been said, in a 'strangely huddled,' 'irregular, confused' packing together of a great many skeletons in a very small space. The first of these causes I believe to have been the most frequent; the second, I am well assured, accounts for the injuries observable in the Rodmarton[1] and the Swell crania. Desiccation and other alterations of various kinds may often have powerfully co-operated towards the production of fissures in these skulls; but whilst the cracking of other organic bodies forbids us to forget the influence of drying, the way in which skulls are often found almost entirely 'perished' makes it clear that we must not leave chemical activities out of sight. These however would not be competent alone to produce lesions which could anyhow be mistaken for wounds.

There can, I allow, be no doubt that skeletons, burnt and un-

were associated—a bronze knife, a perforated stone axe, a hammer of micaceous grit, and a flint implement.

[1] Of the chamber in the Rodmarton barrow, which contained no less than thirteen skeletons, Canon Lysons wrote thus:—'Although most of the human bones exhibited no traces of cremation, some few had been burnt. The bones were all in great confusion, and some had been dragged into a corner.'—'Proc. Soc. Ant. Lond.,' 1863, vol. ii. p. 278. [The Swell crania are described in Article XVIII of this volume. Ed.]

burnt, are frequently found so buried together as to leave no doubt that they were interred simultaneously. The very structure of a cremation long barrow as described ('British Barrows,' p. 495) by Canon Greenwell shows that all the bodies it contains must have been subjected at one and the same time to the action of fire. Burnt bones again are not rarely found[1] in the cists and also in the urns of the ages subsequent to those of the long-barrow builders which give unmistakeable evidence of the presence of more than one skeleton intimately intermingled. Finally, burnt and unburnt bodies[2] are sometimes found so interred together as to show certainly that the two modes of disposing of the dead body were from choice or necessity practised simultaneously. All this however does not prove that of the bodies thus found lying together one set belonged to one and another to another class of men. If one set of bones had really given evidence of the reception by their owners of injuries *ante mortem*, whilst the other was free from any marks of such lesions, there would have been some reason for accepting this view. This however I have shown not to be the case. Or, if it could be shown that in certain barrows one or more skeletons were arranged apart and carefully, whilst other

[1] Interments in urns giving proof of the presence in them of more than one body are recorded in the accounts given in 'British Barrows' of—

Barrow cxlv. 2. Two skeletons in one urn.
Barrow clxxxii. Woman and child in one urn.
Barrow cxcvii. Two adults in one urn.
Barrow ccv. 1. Two women and child.
Barrow ccv. 2. Two or three adults.

Interments in cists giving similar proof of the presence in them of more than one burnt body are recorded in the accounts given in the same work of—

Barrow lxii. Two bodies.
Barrow lxxxii. Woman and child.
Barrow lxxxv. Two children.
Barrow cxxxiii. Two adults.

[2] See for this account of barrows x, xi, xiii, xxvi, lxix, clxi, clxxvi. For the practice of cremation and inhumation simultaneously, see Kemble, 'Horae Ferales,' p. 918; Neville's 'Saxon Obsequies,' p. 11; Wylie, 'Archaeologia,' xxxvii. p. 456; Akerman, 'Archaeologia,' xxxviii. p. 85; 'Inventorium Sepulchrale,' pp. 165, 195; Weinhold, l. c., bd. xxix. p. 138, bd. xxx. p. 176; Lindenschmidt, 'Archiv für Anthropologie,' iii. 114. Burning and inhumation are carried on simultaneously now amongst the Gonds. The women and children of the Máriá tribe are always buried, and Colonel Dalton, 'Ethnology of Bengal,' p. 283, suggests that unmarried males may be similarly disposed of. In the 'Report of the Ethnological Committee of the Jubbulpore Exhibition,' Nagpore, 1868, p. 81, it is stated that burning is considered most honourable amongst the Gonds, but being expensive is usually confined to the old.

skeletons were disposed around such principal interment but in such a way as to show that less care and trouble had been bestowed upon them, much probability would have attached to the view that these latter skeletons might have been those of captives or of slaves slaughtered in honour of the chief represented by the central interment. But I have shown in 'British Barrows,' pp. 530 and 535[1], that where a single undisturbed interment has been found in company with, though distinguishable from, a number of bones giving evidence of the presence with it of several other bodies, these latter bones give evidence of their having been placed as we find them with a certain pious painstaking which arranged them, when parts, not of a body, but of a skeleton, without anatomical knowledge, though obviously with a view to making room for the skeleton found undisturbed. What we have to deal with in such cases as those described above l.c. are cases of successive interments; and if we figure to ourselves how the mingled and allied feelings of reverence and of terror would act upon the otherwise excitable nature of uncivilised men engaged in such a work, we shall have little difficulty in interpreting the phenomena presented to us by the bony remains without having recourse to the hypothesis of human sacrifices, a hypothesis incompatible at once with the care bestowed upon some and the injuries received by others of these remains. The question however here naturally arises, how is it that in the very large number of interments recorded in 'British Barrows' we have never come upon any bony remains bearing their evidence to the existence of a practice which is spoken of by such a very large number of literary witnesses? In answer to this I have to say that the literary evidence when duly considered proves simply that slaves and captives were slaughtered at the funeral of their lords without proving that they were allowed to lie beside them afterwards. The only passage I have met with which might be held to speak of a contiguity in the graves as well as a contemporaneity in the deaths of the masters and of the slaves is the passage in which Caesar writes, as follows, of the funeral ceremonies of the Gauls, B. G. vi. 19: 'Funera sunt pro cultu Gallorum magnifica et sumptuosa; omniaque quae vivis cordi fuisse arbitrantur in ignem inferunt, etiam animalia, ac, paullo supra hanc memoriam, servi et clientes, quos ab iis dilectos esse con-

[1] [See also the description of the Swell barrows in Article XVIII. Editor.]

stabat, justis funeribus confectis, *una cremabantur.*' These two last words might seem to justify us in holding that of the burnt bones packed together in a cremation long barrow with no detectable differentiation indicative of distinctions of rank or position, some nevertheless may have belonged to conquerors, others to captives, or some to masters, others to slaves. If we compare however the words of Homer used in the account of the funeral of Patroclus we shall see that the words of Caesar must not be interpreted too strictly. Achilles, Il. xxiii. 182, says distinctly that the twelve noble Trojan youths were burnt together with Patroclus—

Δώδεκα μὲν Τρώων μεγαθύμων υἱέας ἐσθλοὺς
Τοὺς ἅμα σοὶ πάντας πῦρ ἐσθίει—

using words as precise at first sight as Caesar's '*una cremabantur;*' but a little further on, l. 239–243, we find him telling the other Greeks that they would have no difficulty in distinguishing the bones of Patroclus, for that they were in the middle of the funeral pile, whilst the bones of the human and brute victims were lying apart from them at its edge—

Ὀστέα Πατρόκλοιο Μενοιτιάδαο λέγωμεν
Εὖ διαγιγνώσκοντες, ἀριφραδέα δὲ τέτυκται,
Ἐν μέσσῃ γὰρ ἔκειτο πυρῇ, τοὶ δ' ἄλλοι ἄνευθεν
Ἐσχατιῇ[1] καίοντ' ἐπιμὶξ, ἵπποι τε καὶ ἄνδρες.

[1] According to the legend given by Bartholinus in his 'Antiquitates Danicae,' 1689, pp. 291–292, the spirit of the Icelandic Asmundus was unable to rest until the body of a slave, who had killed himself from unwillingness to survive his master, was removed from his tomb; and we may be quite sure that the haughty and harsh sentiment attributed to that hero, 'Animoso vacuus locus melius placet quam mali comites,' must have been too strong in every age and country which tolerated human sacrifices to allow of any equality between master and slave being set up even in the grave. In two words, I can understand how the bones of slaughtered slaves or captives might lie 'scattered at the grave's mouth,' I cannot understand how they would be likely to find entrance into the tombs of the kings.

[1] Ἐσχατιῇ appears to me to be used in contradistinction to ἐν δὲ πυρῇ ὑπάτῃ of line 165 supra and line 787 of book xxiv, and to furnish a good commentary on the words ἐν τῇ λοιπῇ εὐρυχωρίῃ τῆς θήκης used by Herodotus (iv. 71) in his account of the similar Scythian rites.

There would be no repugnance felt even by men most strongly imbued with those feelings of exclusiveness which Professor Nilsson ('Early Inhabitants of Scandinavia,' ed. Lubbock, p. 167, note) assures us are eminently characteristic of savage life, for joint burial with an equal, a relative, a friend, a wife or a favourite. The words of the prophet of Bethel (1 Kings xiii. 31), 'Lay my bones beside his bones,' show us, as do the repeated notices in the same history of successive monarchs coming or not coming into the tombs of their fathers, the Hebrew feeling on this point; *σφαχθεῖσα συνθάπτεται τῷ ἀνδρί* are the words used by Herodotus (v. 5) in describing the death and burial of the Scythian widow; Greek sentiment has usually a distinctive beauty of its own, but the prayer of Patroclus, Il. xxiii. 83, 84, 91,

> Μὴ ἐμὰ σῶν ἀπάνευθε τιθήμεναι ὀστέ', Ἀχιλλεῦ,
> Ἀλλ' ὁμοῦ, ὡς ἐτράφημεν ἐν ὑμετέροισι δόμοισιν ...
> Ὡς δὲ καὶ ὀστέα νῶϊν ὁμὴ σορὸς ἀμφικαλύπτοι,

is not more Greek than it is Turanian or Semitic; it expresses merely the feeling common to all humanity that they who were lovely and pleasant in their lives in their death should not be divided.

It still remains for me to put on record the little which I have been able to note in the way of abnormalities, pathological and other, in these prehistoric skeletons and skulls.

Of the non-pathological abnormalities observable in this series the persistence of the frontal suture is the only one which needs special notice. It is exceedingly rare for this suture to remain open in the earlier of the two series with which we have been dealing, whilst it is by no means uncommon to find it retaining its infantile patency after the coming of the brachycephalic race. Dr. Thurnam, writing in 1865 ('Nat. Hist. Review,' April, p. 245), said that of all the long-barrow skulls which he had examined, four only, one from the chambered-barrow at West Kennet, a second from the Rodmarton barrow (which has been frequently figured, e.g. 'Cran. Brit.,' pl. 59; 'Archaeologia,' xlii. pl. xiv; 'Thesaurus Craniorum,' p. 8), and two from the Dinnington long barrow (described by me in the 'Journ. of Anat. and Phy.,' iii. 1868, p. 254, Article XIII, p. 159), had been found possessing this peculiarity. To this very small number I have, from all the

Silurian skulls exhumed since 1865, only been able to add the skull of one adult, this one being the skull of the single skeleton found undisturbed in the long barrow at Upper Swell, as described by me (Article XVIII); and one skull of a child of about 7 or 8 years of age, being one of the children found in the chamber of the long barrow at Eyford, described in 'British Barrows,' p. 518, and 'Journ. Anth. Institute,' Oct. 1875, p. 158. Coupling these facts on one side with the well-known fact of the extreme rarity of the persistence of this frontal prolongation of the sagittal suture in the skulls of modern savages[1]; on another side with the fact that this suture persists with comparative frequency in the skulls of brachycephali as observed by His and Rütimeyer in the skulls of their 'Disentis Typus' ('Cran. Helvetica,' p. 27), and by Dr. Thurnam and myself in the skulls of the bronze and later periods; and on a third with the fact that frontal bones with a persistent suture are all but invariably broader than allied skulls not bifid, we may feel ourselves justified in considering the extreme rarity of this suture in Silurian skulls as another indication of their inferiority

[1] This suture persists in a skull of an Andaman Islander presented to the Oxford Museum by Professor Wood Mason of the Indian Museum, Calcutta; it has been noted in an Abyssinian skull by Zuckerkandl, l. c. p. 65; it is seen in the figure of a skull given by Professor Busk ('Natural History Review,' April, 1861, pl. v. p. 174) of a Red Indian from an ancient burial-place in Tennessee, in which skull, Professor Busk informs us, 'the supra-orbital prominence is most marked of all the crania in our possession;' and fourthly, it is seen in the figure of the skull treated of by Professor Broca in his paper (in the 'Bulletin de la Société d'Anthropologie de Paris,' Août, 1871), 'Sur la Déformation Toulousaine du Crâne,' of which we find it recorded that 'l'os frontal est très-petit dans toutes ses dimensions.' But though small frontal bones may occasionally retain this suture, there is no doubt that it is much more usually found in broad foreheads, and that the rationale of its formation lies in the early widening of the frontal lobes of the brain, of the segments, that is, of that organ which are most indubitably shown (see p. 275 supra) to increase in complexity and extent with increase of intelligence. This principle was laid down in the year 1740, by Hunauld in the 'Mémoires de l'Académie royale de Paris,' p. 371; it has been reaffirmed by Dr. Theodor Simon, to whom I owe the foregoing reference, in an excellent though short paper in 'Virchow's Archiv,' tom. 58, 1873; by Virchow himself, l. c., tom. 13, 1858; 'Abhandlungen Akad. Wiss. Berlin,' 1876, 'Ueber einige Merkmale niederer Menschen-Rassen am Schädel,' p. 112, ibique citata; and by Hyrtl, 'Lehrbuch der Anatomie des Menschen,' 8th ed. 1863, p. 245. Welcker's views (given in his 'Wachsthum und Bau des menschlichen Schädels,' p. 99) as to the hereditary transmission of this peculiarity are confirmed by the presence of it in four out of the sixteen skulls recovered by me from the Dinnington tumulus. In two of these not mentioned by Dr. Thurnam the traces of the suture are only rudimentary; and in none of the four does it reach the inner table, which it does however in the Rodmarton and in the Upper Swell crania, both also in this Museum.

to those of the later or Cimbric race. And we are further justified in saying that Mr. Darwin has been misinformed when he says of this suture ('Descent of Man,' 1st ed. p. 124, 2nd ed. p. 39) that it persists 'more frequently in ancient than in recent crania, especially; as Canestrini has observed, in those exhumed from the Drift and belonging to the brachycephalic type.' The true *rationale* of the persistence of the frontal suture would appear to be that it is a teleological accommodation to the needs of the enlarging brain of an advancing civilisation, with which enlargement is correlated a diminution of the size of the jaws, and of the necessity for the rotation of the brain and the frontal bone backwards which has been so often noted here (see p. 240 supra) as occurring in macrognathous men, and which is carried out still further in the 'villainously low foreheads' of the apes.

We may now pass to the consideration of the few pathological deformations which have been noted in these prehistoric skulls and skeletons; and we may begin by recording

I. *Abnormal Ossifications.*

Dr. Thurnam in his 'Further Researches and Observations on the two principal Forms of Ancient British Skulls,' p. 33, suggested that some ethnical importance might attach to the fact that in remains from the long barrows an 'anchylosed condition of two or more of the cervical or upper dorsal vertebrae' had been not rarely observed by him, whilst it was within his experience very uncommon and almost unknown in the round barrows. This condition of things he thought was indicative of some peculiarity, and that peculiarity the troglodytic mode of life of the people in whose remains it had been observed, and whose heads and necks he supposed would have been very much exposed to violent concussions against the sides and roofs of their narrow passages and doorways. Without discussing whether 'anchylosis of the vertebrae may have resulted from such violence,' I would say that I have observed the morbid condition of which Dr. Thurnam writes in many vertebral columns of much later times than those of the cave-dwellers. The Pathological Department of the Oxford University Museum contains, under the Catalogue-numbers 159–165, seven specimens with every appearance of being of modern date; and the magnificent

Catalogue of the Leyden Anatomical Museum[1] has ten Plates (Taf. xxxviii–Taf. xlvii) devoted to this particular form of disease. Of the two specimens of this anchylosis which I have met with amongst prehistoric skeletons, one came from the long barrow at Upper Swell described by me (Article XVIII), and the other belonged to the skeleton 'Paulinus, iv. 2, cxiii. 5,' which came from a round barrow, and indeed may be taken as being a strikingly good representative of the skeletons of the bronze-period. The skull was noted by me as being 'typically brachycephalic both by contour and by measurement (cephalic index = 82), and as having belonged to a strong man, 5 ft. 9 in. in height, and past the middle period of life.' Three of the dorsal vertebrae are glued together by bony deposit on the anterior, and to some extent on the lateral aspects of their centra. In this skeleton, as in two others, also of tall men, from the same neighbourhood and possibly the same clan, viz. 'Paulinus, viii. 2, xv. 2,' and 'Goodmanham, xiv, ci,' it is noteworthy that the last lumbar vertebra has anchylosed with the first sacral, and must, as it enters by its lateral outgrowths continuously into the mass of bone supporting the articular surface which abutted upon the ilium, have so anchylosed at an early period in development. The ensiform cartilage of this skeleton is also

[1] 'Museum Anatomicum Academiae Lugduno-Batavae. Descriptum ab Edvardo Sandifort. 1793–1835. There can be no doubt that this morbid condition is the same as the one spoken of by Rokitansky ('Manual of Pathological Anatomy,' vol. iii. pp. 133, 134, and 247), and described by him as presenting an appearance as if the 'bony matter had been *poured* in a stream over larger surfaces of a bone and had then congulated.' Rokitansky adds, 'We are quite ignorant of any general condition of the system to which this can be attributed.' In default of any suggestion of his, it may be well to add the following short account of the malady from a later writer, Genczig, who in an Inaugural Dissertation ('Ueber Exostosen und Osteophyten') read in 1846 speaks of the malady as follows, p. 14: 'Exostosen der Wirbelknochen. Am käufigsten findet sich ein Osteophyt welches in der Form einer im Flusse erstarrten Masse die vordere Fläche der Wirbelkörper in geringerer oder grösserer Ausdehnung mit einander verbindet. Bisweilen findet sich dies Osteophyt ein höheres Alter ohne anderweitige Krankheiten der Wirbelsäule, bisweilen aber auch bei Caries oder Tuberculose der Wirbelkörper.' I have myself observed this condition in the vertebral column of a Newfoundland dog and of a horse, which are preserved in the University Museum; it is said to be normally present in the dipodidae and dasypodidae, animals, it is right to add, of burrowing habits; but it is also present in many cetacea; and I find that its occurrence as an abnormality is so well known, as to have furnished commentators with a not very satisfactory explanation of Aristotle's twice repeated statement as to the cervical region of the lion consisting of one single bone (see A. F. A. Wiegmann, 'Observationes Zoologicae Criticae in Aristotelis Historiam Animalium,' Berolini 1826; Arist. 'Hist. An.' i. 1, ad fin.; 'De Part. An.' iv. 10).

ossified, and other bones besides those already specified are similarly hyperostotic. Some of the skeletal bones on the other hand, and notably the scapulae, show signs of senile atrophy and thinning, a point of importance to note, as regards both the cause and the time of the production of the vertebral and other hyperostoses.

A skeleton of a Little Andaman Islander described by Dr. Barnard Davis, 'Supplement to Thesaurus Craniorum,' 1875, p. 95, appears to have exemplified almost every possible form of exostosis and synostosis, except the important form of bony anchylosis which consists in the more or less complete coalescence of the first cervical vertebra with the occipital bone. On this Professor Virchow has written at some length in his recently issued volume, 'Beiträge,' pp. 340–345. Professor Virchow puts on record five cases of this variety, three of which have come under his own observation, whilst the other two have been described by Bogstra in conjunction with Boogaard and Friedlowsky. A somewhat larger number are described in the already cited 'Catalogue of the Leyden Anatomical Museum' (vol. i. pp. 143, 144; vol. ii. Taf. xiv, Taf. xv; vol. iv. pp. 31, 46, Taf. clviii. fig. 1, 2, 3), with the remark that 'ex descriptis speciminibus diversimode cranium cum atlante concrescere constat.' There are two specimens of this anchylosis in the Museum of the Royal College of Surgeons of London; one being an artificially distorted skull from Vancouver's Island, No. 5412 A, and the other, the existence of which was notified to me by Professor Flower, being the partly-burnt skull, No. 5903, which was supposed, but probably erroneously, to have belonged to a native of Van Diemen's Land. We have five specimens of this very interesting pathological deformation in the Oxford University Museum, three in the Pathological Museum, and two in the Ethnological Series. Of the three in the Pathological Museum, one, No. 157, belonged to a man who died at the age of 73, and the second, third, and fourth cervical vertebrae are anchylosed to each other just as the atlas is anchylosed to the occipital. In this case, as in Friedlowsky's, the posterior arch of the atlas is left incomplete, an interval of two millimètres separating it into two halves. The second belonged to a boy who, after suffering from various scrofulous affections, died with cough, purulent expectoration, hectic, and vomicae in the right lung, as well as extensive paralysis from, no doubt, encroachment effected by the odontoid

upon the medulla oblongata. Of these two cases the first resembles one of the two recorded by Virchow from the Berlin Museum, in that death took place at an advanced age and without any recorded symptoms of disease connected with the lesion in question; the second resembles the second of those cases, in that long disease was the cause of death. The third specimen from the Oxford Pathological Department, No. 261, is the skull of a lunatic, purchased with the Collection of Schröder van der Kolk, the calvarial bones of which present, according to the Catalogue, 'a rugous wormeaten appearance, a consequence either of syphilis or tinea.' Our fourth specimen was obtained from a Roman cemetery at York, in which large numbers of skeletons were found buried in *putei* with very little regard to any consideration, except that of making the largest possible amount of room for the largest possible amount of bodies to be interred. No clue to its nationality, therefore, except in the political sense of subjectdom, is available. The specimen however is of interest with reference to the question of the foetal or congenital origin of the anchylosis, as not only the spheno-basilar synchondrosis would appear never to have been closed, but also the basilar portion of the occipital bone would appear to have been entirely absorbed, and the arch of the atlas to have coalesced all but perfectly with the occipital, two circular orifices only remaining for the outlets of the first spinal nerves. It is of interest further, as combining with this anchylosis, firstly the 'plastic deformation' of Dr. Barnard Davis, the 'basilar impression' of Virchow (l. c.); and secondly, a flattening and widening out of the cranial vault, the height from the edge of the anterior arch of the atlas next to the base of the brain up to the vertex being only 4″ as against a maximum width of 6·2″, so as to give the skull what Dr. Barnard Davis calls a 'discoid,' and Virchow (l. c.) a 'molenförmig' appearance. Our fifth skull belonged to a man (Cowlam, lvii. 3) of from twenty-five to thirty years of age, whose shortness of stature (5′ 1″) and ill-filledness of skull (with cephalic index of 76) would point to his having belonged to the stone age, a supposition which his archaeological surroundings do not, I apprehend, contradict ('British Barrows,' pp. 215–6). In this skull a considerable part of the occipital bone has been lost, but on the left side its condyle has been left with the articular process of the atlas anchylosed to it without any trace of recent discontinuity.

Professor Virchow appears to consider these cases explicable by the action of an arthritis chronica deformans; Friedlowsky ('Wiener Med. Jahrbücher,' 1868, Bd. xv. p. 241; cit. Virchow, l. c. p. 343) is inclined to believe them to be due to intra-uterine disease; in some cases I should suggest that they were the result of strumous disorganisation occurring in early life but recovered from, as we have seen recorded in two of the cases here referred to, so completely as to allow of a goodly old age being attained to. It is perhaps difficult to assign any other ethnological bearing to them than that which they have had conferred upon them by being discussed in the important ethnological memoir referred to.

The skeleton 'Goodmanham, xiv, ci,' already mentioned as having had the last lumbar vertebra anchylosed to the first sacral, presented another form of exostosis, which, as it did not affect the joints, cannot be ascribed to an arthritis (see Adams, cit. Paget, 'Lancet,' Nov. 18, 1875). An osseous upgrowth on the tibia, 2″ long by ·6″ in height and ·35″ in width, roughened and perforated here and there, occupies the part of the popliteal line which is common to the popliteus and the inner head of the soleus; the bone is further beset by rough and by smooth exostosis on its border below this level, and is finally joined, by a stalactitic growth 1·25″ long and ·7″ thick, to the fibula.

That particular form of exostosis which produces in its most usual form what is called the puerperal osteophyte is by no means unrepresented in prehistoric series. As in modern times also, it is not confined to the female sex exclusively; a typically male skull of the brachycepalic type from a grave in a barrow at Gardham exemplifying it.

Finally, we have in the long-barrow series from Market Weighton, Rodmarton, and Swell, that form of hyperostosis which developes masses of bones along the supraciliary ridges, as repeatedly observed in Australian and Tasmanian skulls (see 'Catalogue Ost. Series, Royal College of Surgeons,' vol. ii. 1853, Nos. 5317, 5318, 5324, 5345), as also in foreign skulls of prehistoric times, e.g. the Danish skulls from the Island of Seeland, as noted by Virchow ('Arch. für Anthr.' iv. p. 66; see also Spengel, ibid. viii. p. 59, 1875, and 'Journ. Anth. Inst.' Oct. 1875, p. 170.

II. *Rickets.*

I am inclined to believe that we have an example of the working of what has been called an 'English disease,' viz. Rickets, in one skull of the bronze period, 'Rudstone, lxiii. 4,' 'British Barrows,' p. 248. The calvaria of this cranium is so large relatively to its small facial skeleton and lower jaw, and has so distinctly the subquadrate outlines which we have learnt[1] to recognise as indicative of that false cerebral hypertrophy the essence of which consists in an increase, not of the nerve cells, but the interstitial neuroglia, that we are probably justified in considering it to have taken this shape and size in accommodation to a rickety brain.

The skull appears, from its small mastoids and small teeth and jaws, to have belonged to a woman, and somewhat difficult though the size and weight of the entire skull and the considerable development of the supraciliary ridges may make it to believe this, the existence of a considerable quantity of stalagmite-like exostosis on the interior of the frontal bone lends some additional probability to this view as to its sex, as does also the comparative verticality of the forehead and of the posterior part of the parietals. As rickets may appear, as Sir W. Jenner (l. c. p. 466) has shown, in any child whose mother may have been in a depressed condition during the period of gestation, no matter whether the father may have been in 'robust health and the hygienic conditions most favourable,' there is no need for wondering at its appearance in a semi-civilised community, where early childbearing and hard labour would usually be the lot of the females. In the present case the malady had been outlived, and the subject of it, to judge from the great wear of the teeth and the obliteration of the skull sutures, had reached old age. The teeth are small in size, and only three molars appear to have been implanted in the jaws, two on the left, one on the right side.

The measurements of this skull are as follows:—

Extreme length	7·4″	approximatively. Interzygomatic width	4·7″
Extreme breadth	5·7″	approximatively. Interangular width of lower jaw	3·2″
Vertical height	5·8″	approximatively. Depth of symphysis	0·9″
Circumference	21·4″	approximatively. Width of ramus	1·2″
Length of face from fronto-nasal suture to edge of alveolar process	2·5″	Cephalic index	76
		Weight of skull with lower jaw but with loss of basicranial bones = 1 lb. 7¼ oz.	

[1] West, 'Diseases of Children,' Lectures X and XLI, pp. 134 and 729, 5th edition,

A second skull, to which the foregoing description as to age, sex, contour and other characters, with a slight alteration as to the supraciliary ridges being smaller, would apply almost word for word, was obtained by Canon Greenwell from a cave at Ryhope in the county of Durham. With this skull and lower jaw there came to the University Museum from this cave a second lower jaw, which had belonged to a strong man, and resembles in many particulars the lower jaws of the earlier British prehistoric race; and the lower jaw of the skull, altered by cerebral hypertrophy, has its angles inverted in a manner frequently noticeable in lower jaws of early races. These points have some importance, as some doubt exists as to the date of this 'cave-find.' The measurements of this Ryhope skull are as follows:—

Extreme length	7·4″	Interzygomatic breadth	4·7″
Extreme breadth	5·6″	Interangular width of lower jaw	3·1″
Vertical height	5·3″	Width of ramus	1·3″
Absolute height	5·0″	Depth of symphysis	0·9″
Circumference	20·8″	Weight of skull 1 lb. 5 oz. 70 grs.	
Length of face	2·3″		

III. *Diseases and irregularity of teeth in Prehistoric Series.*

Mr. Mummery in a valuable paper published firstly in the 'Transactions of the Odontological Society of Great Britain,' vol. ii. p. 1, Nov. 1869, and subsequently (1870) in a separate form with additional notes, has given at considerable length, and also tabulated, the results of his observation upon dental disease as existing in prehistoric races, having examined for this purpose a large proportion of the series in the Oxford Museum and also several other collections. In the same paper he has also recorded the results of his investigation of dental disease in various existing savage tribes, such as the Australians, the Eskimos, the Negroes, and the Red Indians. Mr. Mummery has pointed out that amongst as many as sixty-eight Wiltshire skulls of the long-barrow period in Dr. Thurnam's collection he could find only two cases of decay, whilst amongst thirty-two skulls in the same collection from the round-barrow period there were seven cases. In sixty Yorkshire dolichocephali, however, Mr. Mummery says no less than twenty-four

1865; Jenner, Lectures on Rickets, 'Med. Times and Gazette,' 1860; Virchow, 'Untersuchungen über die Entwickelung des Schädelgrundes,' Berlin 1857, pp. 99–102, ibique citata.

exhibited more or less disease; and in forty-four other skulls ranged with the long-barrow series, some from Mr. Bateman's Derbyshire series and some from other sources, much wearing down of the teeth and nine cases of caries were noted; but alveolar abscesses were comparatively rare. In the Park Cwm tumulus in the peninsula of Gower, South Wales, described by Sir John Lubbock ('Journal Ethn. Soc. London,' vol. ii. 1870, pp. 416–419), and of the same 'horned' character and possibly of the same race and time as the Gloucester tumuli next to be spoken of, amongst skeletal remains representing twenty-four individuals, twenty-one of whom were adults, Dr. D. M. Douglas found 'the teeth wonderfully preserved, very good and regular,' and 'only two that exhibited signs of decay during life.' In my examination of the entire series of bones, fragmentary as well as perfect, from several chambers in long barrows in Gloucestershire, I find very much the same state of things which Mr. Mummery has described from the Wiltshire burials of the same period. Ten lower jaws, nine of which were from persons beyond the age of puberty, were recovered from a chamber in the long barrow described by Canon Greenwell, 'British Barrows,' pp. 514–520, and by me in the 'Journal of the Anthrop. Instit.,' Oct. 1875, p. 160 (Article XVIII); and of them I write (l. c.), 'In none of these lower jaws had any teeth been lost before death, in only one is there any caries visible, and in one other (of an old woman) there is a cavity formed by an alveolar abscess in connection with a lower front molar worn down to the fangs and with its pulp cavities almost obliterated by osteodentine.' Similarly of the six lower jaws, all but one of which must have belonged to strong adult men, recovered from a chamber in the long barrow at Upper Swell described by Canon Greenwell in 'British Barrows,' p. 521, and by me in Article XVIII, I write, 'In every case but one the full number of teeth was retained up to the time of death, even though the teeth are very much worn in most cases, and in some even down to close upon the fangs. There was only one case of caries.' I should have added that some traces of an alveolar abscess are to be seen in the jaw which had lost teeth before death, and that this jaw appears to have belonged to a man, whilst the jaw with caries belonged probably to a woman.

On the other hand, of the teeth of three females, also already described by me and all undoubtedly from the stone and bone

period ('Journal Anth. Inst.,' vol. v. p. 152, and vol. vi. p. 34), a very different history has to be given. Of the first of these, from the barrow 'Nether Swell, ccxxix,' I write, 'The lower jaw is feeble. The mental foramen corresponds to the interval between the second bicuspid and first molar. The teeth are very much worn down, and there are two or three alveolar-abscess cavities in the jaw. One very large one occupies a great part of the molar region of the left upper maxilla.' One of the male skulls from this barrow shows the cavity of a small alveolar abscess; and in another several teeth had been lost before death. The second of these cases is that of the woman recorded in 'British Barrows,' p. 518, and 'Journ. Anth. Inst.' l. c., p. 158, of whom in the latter place I say, 'The lower jaw of the old woman was feeblish as compared with some of the male jaws, but not with all, from these barrows. It had lost no teeth, from the half we recovered, during life, though the teeth were very much worn down, and the first molar, notably, down to its fangs; in connection with both of which there were alveolar abscesses.' Of the femur and other bones belonging to this skeleton I say that they 'give the idea of their owner having had hard work and poor food, viz. as they are slight, but with rough ridges.' The third instance is furnished by the history of the young woman found at Cissbury ('Journ. Anth. Inst.,' vol. vi. p. 34), in whom an alveolar abscess existed in relation with a lower premolar, which had had its pulp cavity exposed by being broken across midway between its grinding surface and its neck. Here the two anterior molars were very much worn down, though their owner was not more than twenty-five years of age, and the wisdom teeth were scarcely worn at all. Subsequently to these excavations two lower jaws affected with alveolar abscesses, both of aged females, were found in the long barrow No. ccxxxii, Nether Swell (Article XVIII); another similarly affected, but from a powerful old male subject, was found in the same barrow. A third as yet undescribed skull of an old woman of the stone period, with extensive traces of the same mischief, was presented to me by the late Rev. Canon Lysons, having been obtained by him from a long barrow in Gloucestershire; and three of the Rodmarton long-barrow skulls, also from the collection of that antiquary, one of an old man, one of the young man already referred to (p. 295 supra), and one of an old woman, have suffered similarly. Of eight lower

jaws, of all ages and both sexes, discovered by Edward Laws, Esq., in a cave near Tenby (see 'Journ. Anthrop. Institute,' July, 1877), to the early date of which their possession of the 'priscan' peculiarities specified above (pp. 243–249) speaks as decisively as their archaeological surroundings, one only, a lower jaw of a man, had been affected by alveolar abscess. From the Westow long-barrow series ('British Barrows,' p. 494) no lower jaw thus affected has been recovered; from the Rudstone long barrow (Ibid. p. 497) only one (the one described above, p. 211, as) of a man; from the Ebberston long barrow ('British Barrows,' p. 484) only one, of a woman[1].

Further investigations may possibly reverse this relation of numerical superiority on the side of the female sex in the matter of alveolar abscesses. I am inclined however to connect it with the harder life and scantier fare which are the lot of women in most savage races, upon which I have here (p. 258 supra) and elsewhere[2] insisted as accounting for the greater inferiority in stature and in bulk which existed and exists between men and women in many ancient and in many modern savage races.

Feeble general physique is correlated, as Mr. Mummery's examination of modern savage races (pp. 47, 51–54, 60, 63) in Africa, China, Australia, and elsewhere has shown us, with deterioration of the state of the teeth, and this, howsoever, whether by too small a proportion of animal to vegetable food in their dietary, by frequent privation of food altogether, or by general anti-hygienic conditions, this feebleness may have been produced. To realise the working of the two former of these causes among the prehistoric inhabitants of these islands, and especially the women, there is little need of imagination; I think however that from our present familiarity with the production of anti-hygienic conditions by the crowding of a superabundant population within solid walls, from our lack of familiarity with tent life and savage life, we may underrate the

[1] In none of these cases have I seen any traces of the simple but relief-producing operation of extraction, or of other evidence to show that in this, any more than in any other sphere, 'the former days were better than these.' The same lesson may be gathered analogically from observations made upon the remains of modern savages, Mr. Mummery informing us (l. c., p. 47) that he has 'met in Australian jaws with every form of dental disease with which we are familiar amongst the English race.'

[2] 'Journal Anth. Inst.,' Oct. 1875, p. 121 note; 'British Association Report,' 1875, p. 152; 'Archaeologia,' xlii. 1870, p. 457.

extent to which unhealthy conditions may, or indeed must have prevailed in the dwellings even of sparse populations in days so long before the invention not merely of glass but of many other things in which in these days 'our basest beggars are superfluous.' It is obvious however upon the smallest consideration, even in the absence of any personal acquaintance with present savage life, that the dwellings of the races we are dealing with must have been dark and crowded to secure warmth, and that the female portion of the tribe would have a larger share of these as of other depressing influences to contend with than the males. And the effects of these influences would show themselves as surely and clearly in the teeth, a system most closely correlated with the general state of the whole organism, as in their feebler trunk and limb bones[1]. The great frequency of the perforation in the olecranic fossa of female prehistoric humeri, noticed by Broca ('Mémoires,' ii. p. 366, and 'Rev. d'Anthropologie,' 1873, ii. p. 15) and instanced by me ('Journ. Anth. Inst.' v. pp. 149–159, 161–169, Article XVIII) in four cases from the Swell long barrows, is to be similarly explained; and, conversely, its absence in the Cro-Magnon and Mentone skeletons, which belonged to the 'giants' of tradition.

I have not, though constantly careful in looking for irregularities in dentition, found many in either of the prehistoric series which I have examined. Three of retardation of one or both bicuspids with retention of the second milk molar in persons of fourteen to fifteen years of age ('Jarrett, cxix,' p. 328, 'Money Hill, cxxi. 3,' p. 330, and 'Flixton, lxxi. 1,' 'British Barrows,' p. 275) may be men-

[1] The slovenly habits of savages, carnivorous as well as vegetarian, by allowing of the admixture of sand with their food, furnish a very efficient means for wearing down of the teeth. But the inland tribes, who, like the outcasts described in the book of Job (chap. xxx. ver. 3–8), 'cut up mallows by the bushes, and juniper roots for their meat,' suffer more from the secondary consequences of such wear, which we have been speaking of as alveolar abscesses, than do the game-, fish-, or shellfish-eating races, such as the tribes represented by the Cro-Magnon and Mentone skeletons, or the Eskimos and Vancouver Island Red Indians. For the action of unintentionally introduced sand, see Wilson, 'Canadian Journal,' Sept. 1862, p. 12, March, 1863, p. 151; Mummery, l. c., pp. 35, 36; Pengelly, 'Trans. Devon Association,' 1874, vi. p. 307, compared with p. 302, where the cave earth of the Mentone Cave is described as being 'a perfectly dry, very fine, incoherent, greenish sand.' For the wear of the teeth in the Cro-Magnon skeletons, see Broca, 'Mémoires,' ii. pp. 166–168; for that of the skulls from the Caverne de l'Homme Mort, see 'Revue d'Anthropologie,' 1873, ii. p. 17. The similar sufferings of later races in possession of cerealia may be referred to the detritus of their querns and grain-crushers.

tioned and compared with the similar cases given at p. 237 of the second edition of the 'System of Dental Surgery' by J. Tomes and C. S. Tomes. Another of the retention of a wisdom tooth, with its upper surface only just visible above the alveolus in an aged female skull, 'Cowlam, lvii. 3,' 'British Barrows,' p. 216, may be mentioned as exemplifying another kind of retardation which is perhaps more common among women than men, as is also, I incline to think, the entire obsolescence of the wisdom teeth.

The somewhat rare anomaly constituted by the presence of two roots to the lower canine has been noted by me in lower jaws from no less than five of the earlier interments treated of in this book; from, to wit, the long barrow ccxxix, at Nether Swell, described by me in the 'Journal of the Anth. Inst.,' Oct. 1875, vol. v (Article XVIII); from the cremation long barrow at Ebberston ('British Barrows,' p. 484); from the chambered long barrow at Rodmarton ('Cran. Brit.' pl. 59); from the Dinnington[1] barrow, described by me in the 'Journ. of Anat. and Phys.,' 1868, vol. iii. p. 254 (Article XIII); and, fifthly, from the Longberry Cave, near Tenby, examined by Mr. Laws (see p. 305 supra). The importance of this, which may appear to some readers to be a curious rather than a

[1] Some doubt may attach to the assignment of the Dinnington barrow to the long-barrow period. I was not an eyewitness of the examination of it, though I, subsequently to the removal of it, made enquiries on the spot from persons concerned in that work, and recorded them l. c. Eighteen more or less perfect skulls had been reinterred after the removal of the barrow; these, through the kindness of J. C. Athorpe, Esq., I recovered; they are all dolichocephalic, and measurements of them were taken by Dr. Thurnam and recorded in the 'Memoirs of the Anthropological Society of London,' vol. i, and 'Crania Britannica,' tab. ii. p. 242. Casts of one of these skulls have been taken and are referred to by Welcker, 'Archiv für Anthropologie,' i. 1, p. 149, and by Ecker, ibid. i. 2, p. 283, as illustrating well the 'Reihengräber' form of the latter anthropologist; and Dr. Barnard Davis has described this cast in his 'Thesaurus Craniorum,' p. 10, as being 'very large, even enormous,' and 'subscaphocephalic.' I may mention in support of the view, which however I do not hold to be absolutely proved, that this barrow should take rank with those of the neolithic age, the fact that out of twelve lower jaws recovered by me from the reinterment, no less than six combine the wide ramus, the short coronoid, and shallow sigmoid notch so characteristic of priscan jaws, with a rounded and slightly inverted angle; whilst in three of the other six the same rounding of the angle of the jaw is present with the same inversion, sometimes considered peculiarly significant; and that whilst in many cases the chin has an eminently feeble, in none of them has it the powerful development so common in the lower jaws of the later occupants of this country.

For other references to this Dinnington barrow, see 'Bulletin Soc. Anthrop. Paris,' sér. i. vol. v. pp. 541, 578; 'Natural History Review,' April, 1865, p. 245; 'Archaeologia,' xlii. p. 171.

significant fact, will be seen very plainly when I add that all the other lower jaws from every period, inclusively of the bronze down to the present day, and from almost every variety of our species available in the ethnological series of the Oxford Museum for this comparison, have only furnished to me seven specimens with similarly bifid canine-fangs, and that of these seven only one belonged to a modern civilised race. This one presented other anomalies in its dentition which should render it perhaps unnecessary to consider it here, and the same may possibly be said of yet another of these seven, inasmuch as it belonged to the skull 'Rudstone, lxiii. 4,' which has already been referred to (above, pp. 301–302) as furnishing some evidence for the existence of the disease rickets in the bronze period. Of the other five, one was found amongst more than a hundred Peruvian crania obtained from the collections made by Consul Hutchinson; two came to me from among six lower jaws collected for me in South Africa by the late Mr. Frank Oates of Christ Church, the small size, low coronoids, and feeble chins of which indicate that they probably belonged, as reported, to an outcast tribe, probably Bushman (Article XXV); a fourth belonged to a 'pure-blooded Gond,' as guaranteed by the donor, Captain H. A. Hammond, from Chindwara in Central India; the fifth, curiously enough and also suggestively, belonged to one of the South Welsh skeletons buried in the time of Charles I, as referred to above, p. 170, note.

Pruner Bey ('Bull. Soc. Anth. Paris,' sér. ii. tom. ii. p. 244, 1867) has recorded the discovery of a similarly bifid canine from the famous cave-find of Naulette, in which, it may be added, evidence of a lower-jaw wisdom tooth with quinquefid fangs, and of extremely small incisors, was also found (ibid. tom. i. p. 587). The transversely placed sockets of these fangs are very frequently represented rudimentarily by raised ribs on the walls of undivided sockets, and the same may be said of the sockets of the lower premolars, which however I have never seen bifid, but which, judging from the position of these raised ridges, would have had such double fangs placed transversely to the jaw like those of the canines, not anteroposteriorly like those of the molars behind them, or of their homologues in Simiadae.

If the importance of the fact of the greater relative frequency of bifidity of the lower canine-fang in 'priscan' races and modern

'Naturvölker' is plain enough, the same cannot be said of the interpretation or signification of the fact. In none of the recent, nor, so far as I can learn from plates, in any of the fossil Simiadae, has any fission of the fang of a canine been observed; indeed the lower-jaw canines in this family with their single fangs and the lower-jaw premolars with their invariably double ones differ from their human homologues more strikingly than do any of their other teeth. It is true that in some even of the Cynomorphous Simiadae the fang of the lower canine is laterally grooved as well as laterally compressed; and in the gorilla the long diameter of the oval section of this fang forms a much more widely open angle mesially with the long axis of the molar series than it does in the chimpanzee or orang. Still these are but approximations to what is fully carried out in the bifidity of the human canine fang; and though we may speak of them, therefore, as 'anthropoid,' we cannot speak of it as 'pithecoid.' To my thinking a fair expression of the facts may be given by saying, the interchangeability of form which exists between 'canines' and 'premolars,' but which ordinarily requires for its illustration the comparison of two distinct species, is exemplified by different varieties within the limits of our own single species. If in this instance we have to go as far afield as are such animals as *Galeopithecus*, *Erinaceus*, and *Talpa*, to understand how a so-called 'canine' can become 'premolariform' and develope two fangs, it is but one instance out of many which show that many questions in anthropology can be read only in the light furnished by comparative anatomy[1].

I have not observed in these series any wisdom teeth with that larger development which is so commonly noticeable in the dental series of Australians as compared even with other black races, not to say with Europeans. Rather indeed the reverse, the wisdom teeth being often very small, especially in female skulls of the earlier series. Nor in spite of the grinding down which is so marked a feature in many of these skulls, as for example in the skull of the woman from Cissbury, described by me in the 'Journal of the Anth. Inst.,' vol. vi. p. 34 (Article XIX), have I ever observed

[1] For a philosophical discussion of the homologies and nomenclature and the interchangeability of form in mammalian teeth, see Messrs. Moseley and Lankester, 'Journal of Anatomy and Physiology,' Nov. 1868, ser. ii. No. iii. p. 73, and Mr. C. S. Tomes, 'Manual of Dental Anatomy,' 1876, p. 260.

the eruption of these teeth to have been provoked, as is sometimes the case in savage races, into taking precedence of the union by ossification of the occipital and sphenoid bones. Such precedence has been noted by Professor Broca[1] in one of the Cro-Magnon skulls; and from his comparison of the skulls of various modern savages between the ages of eighteen and twenty-five with skulls of modern Europeans at the same period of life, it results that this peculiarity must be considered as a mark of degradation.

Several other notes of inferiority which are commonly found in savage races of modern days, and which have been described as existing in the remains of troglodytic man, are wanting in the neolithic skeletons which I have examined. Foremost amongst these may be mentioned prognathism; a peculiarity which our knowledge of the extent to which the jaws are modifiable and modified by the nature of the dietary alike in the lower races of man and in the lower animals would certainly lead us to expect to find amongst a stone- and bone-using people. But, as it has often been remarked[2], the facial angle of these early races is by no means small, and their jaws have none of that pithecoid elongation which is so striking and prominent a characteristic in the crania of many still existing savages. On the other hand, prognathic and macrognathic jaws are not rare, though they are not the rule, in series from the bronze, and also from the early iron period in this country.

A second mark of inferiority, not entirely unexampled among modern savages, the junction, namely, of the squamous to the frontal bone, has never to my knowledge been observed in any prehistoric crania. If this peculiarity had been present its significance would have been very great, as denoting a curtailment of the part of the brain which, corresponding to the great ala of the sphenoid in the skull, is eminently favourably conditioned, both as regards vascular supply and histological constitution.

I have already remarked (pp. 236, 248 supra, and 'Journ. Anth. Inst.,' vol. v. p. 126, Article XVIII) that a third mark of in-

[1] See 'Revue d'Anthropologie,' 1873, ii. p. 20. Dr. Barnard Davis in his 'Thesaurus Craniorum,' 1867, p. 309, observes of a Loyalty islander, 'æt. c. 25,' that 'the synchondrosis sphenobasilaris is not quite ossified, yet all the teeth have been cut.' This is the ordinary sequence in the lower animals.

[2] Broca, 'Mémoires,' ii. p. 197; 'Rev. Anth.,' l. c., p. 19; Thurnam, 'Principal Forms,' p. 32.

feriority, that, namely, which is constituted by diminution of the height of the skull, absolutely as well as relatively to its long and transverse diameters, is not usually noticeable, except in the female skulls of the dolichocephalic long-barrow race. To this may be added that in the series from the Caverne de l'Homme Mort, belonging to an early period of the neolithic age, Professor Broca found the height of the female actually exceeding that of the male skulls in the proportion of 132 millimètres to 131.

If we miss in these neolithic crania the diminution of the height of the skull which Professor Busk has, under the name of 'tapeinocephaly,' noted in certain modern savages, we look almost equally in vain amongst them for a fourth point of degradation, the elongation, to wit, of the basicranial axis; a peculiarity which Professor Cleland has rightly insisted upon ('Phil. Trans.' 1870, p. 124) as being strikingly and remarkably characteristic of uncivilised nations as distinct ethnographically as the Esquimaux, the Kafirs, and the Caribs.

I have already (p. 236[1]) noted that the basis cranii in these ancient crania has never been found by me to have suffered from that pathological degradation which is known as the 'plastic deformation' of Dr. Barnard Davis, the 'basilar impression' of Virchow, the 'impressio baseos cranii' of other authors.

The nasal index, which fails to separate the Eskimo from the civilised races, fails equally with the long-barrow skulls, and, as has been pointed out by Professor Broca ('Rev. Anth.,' 1873, ii. p. 19), with other prehistoric European skulls. On the other hand, the orbital index, which does put the prehistoric crania from Cro-Magnon and the Caverne de l'Homme into a position of similarity to skulls such as those of the Tasmanian, Australian, and Melanesian races, puts the neolithic skulls of British barrows into a position of superiority as compared, not merely with the modern savages just mentioned, but even with the skulls of the bronze period. As regards these latter skulls however, it should be remarked that the

[1] The references made by me elsewhere (pp. 289–298 supra) to this interesting pathological change were made merely for the sake of illustration. Dr. Barnard Davis's paper was read before the Anthropological Society of Paris, June 5, 1862, and may be found in 'Mém. Soc. Anthrop. de Paris,' tom. i. p. 380. Subsequently a memoir upon the subject was published by Dr. Boogaard in the 'Nederland Tijdschrift voor Geneeskunde,' 1865, 2. p. 81, an analysis of which by Dr. W. D. Moore appeared in the 'Journal of Anatomy and Physiology,' Nov. 1866, p. 179.

transversely oblong outline which their orbital border sometimes assumes, as in the skulls 'Heslerton Wold,' described and figured at pp. 181–182, and 'Rudstone, lxiii,' described and figured at pp. 190, e. s., is due to an excessive downgrowth of the supraciliary ridges, rather than to any curtailment of the distance between the actual roof of the orbit and its inferior or maxillary border. In other words, just as the prognathism of modern savages may depend simply upon increase in size of the anterior alveolar segment of the upper jaw, so a low orbital index may be and often is due to a downgrowth of the upper border of the orbit, which comes thus to lie in a plane much lower than that which the true roof of the orbit occupies.

Professor Broca, in his account of the skulls from the Caverne de l'Homme Mort ('Rev. Anth.' l. c. pp. 26–28), after enumerating the various points in which those nineteen crania contrast and agree severally with those of the earlier race represented at Les Eyzies on the one hand, and with those of later races on the other, declares himself of opinion that the race to which they belong, whilst affined to the palaeolithic man, has no longer any distinct representatives upon the area which it once, however imperfectly, occupied. It must be very difficult to attain to anything like perfect certainty upon such a point in view on the one side of the tenacity with which so-called 'indigenous' or 'autochthonous' races retain, in whatever political or social status, a foothold in their 'aboriginal' country; and, on the other, of the modifying influence which the introduction of agricultural and other improvements may have exercised in the course of many centuries. Without going, however, further into this question, I will say that a comparison of the skulls here dealt with from the stone and bronze periods with those of the mediaeval and modern tenants of these islands, coupled with other considerations and carried on for a considerable number of years, has inclined me to hold that the two prehistoric races, though outnumbered greatly by Anglo-Saxons, are still represented in the population of Great Britain and Ireland. The short-statured, dark-haired, long-headed race which is found not only making up nearly the whole population of large 'Welsh'-speaking districts in Wales itself and in the Highlands of Scotland, but also mixed up, and in very large proportions, with the population occupying midland-county districts usually held to have been entirely

Saxonised and Danicised, as pointed out long ago (see p. 279 supra) by Professor Phillips, we have many reasons for holding to be the lineal descendants of our long-barrow people. In the north of England we find that the neolithic race amalgamated peacefully with the brachycephalic stock which taught them the use of bronze; and in the early iron period (see p. 283 supra) the earlier race appears to have regained some of its numerical preponderance, the late Celts from the East Riding and elsewhere north of Yorkshire having been mostly dolichocephalic. The bronze-using race seems, in the southern parts of this country, to have more completely absorbed or destroyed the dolichocephalic than it did in the north, resembling in this the dolmen-builders of France, whose predominance brought about an almost entire disappearance of their neolithic and troglodytic predecessors (see Broca, 'Revue d'Anthropologie,' ii. pp. 49, 50, iv. p. 608). Still a race with many of the physical peculiarities of the long-barrow people is represented in great abundance in the cemeteries of the centuries during which this country was divided into Roman latifundia and forest-land; and whatever may have been their social or political status, the dolichocephali enjoy in such interments a great numerical superiority as compared with the brachycephali. The 'Saxon' or 'English' conquerors of this country have been shown (see 'Archaeologia,' xlii. p. 460; 'Proceedings of the Royal Institution,' 1870, p. 118) from the examination of their burial-grounds, as well as of other evidence, to have displaced the population they found in occupation of it as entirely and completely[1] as it has ever been found possible for invaders to do. The existence in the England of those days of large woods and forests and marshes, a point dwelt upon by Professor Pearson at pp. 4 and 24, and illustrated by several of his 'Historical Maps of England,' must have made the entire extirpation of the Romano-British population an impossibility[2]; and enables us to

[1] In this, which appears to have been a very thoroughly Teutonised district, the crania of the present agricultural population appear to me to be very closely similar to or indeed scarcely distinguishable from those of the Saxons of the times when they first discontinued cremation.

[2] Captain Thomas ('Proc. Soc. Ant. Scot.,' April, 1876, xi. part ii. p. 504) may be quite right as to his 'theory of the entire removal by slaughter or flight of the Celtic people' of the Hebrides; but the evidence from 'place-names' is not by itself sufficient to support this conclusion. The 'place-names' in many districts of England in which the so-called 'Black Celts' are still largely represented will be found to be exclusively Scandinavian or Saxon. Small islands of course which have neither dense

understand how even in the time of Canute British outlaws carried on brigandage even in such counties as Huntingdonshire.

There is of course no need to adduce any argument in favour of the self-evident proposition that the brachycephalic metal-using Celt was in date but of yesterday as compared with the troglodytic men of the continent; but the line of argument which may be employed in favour of this conclusion as regards the neolithic man of our long barrows, that, namely, such as it is, which rests upon the continuity of descent which appears to connect this stock with the dark Welsh and Gael of our own days and country, would not admit of being so used as regards the later race. For, as has been above (pp. 226, 227, 281) pointed out[1], the cranial and skeletal characters of the bronze-using Celt are very closely similar to those of the mediaeval and modern Dane; and this similarity must of course make it difficult to decide whether the brachycephalism of many crania procurable from mediaeval and especially urban mediaeval interments, is to be referred to the persistence of such a brachycephalic prehistoric stock, or to the admixture of Danish blood in historic times upon which writers such as Worsaae ('The Danes and Norwegians in England, Scotland, and Ireland,' 1852) and Isaac Taylor ('Words and Places,' 1865, p. 183) have insisted with so much force. The discovery however by Dr. Thurnam and myself[2] of numerous skeletons of a typically brachycephalic tribe in a tumulus belonging to a period close upon that of the Saxon invasion, and situated at Crawley in Oxford-

woods nor lofty mountains to serve as refuges to their occupants may, as the miserable history of the Greek Archipelago has shown from the time of Datis and Artaphernes (Hdt. vi. 31) down to our own, have their inhabitants entirely extirpated. And this may have been the case when the Hebrides were invaded by the Northmen. But as regards larger islands and continental areas the lines from Wordsworth's 'Poems dedicated to National Independence and Liberty,'

'Two voices are there; one is of the sea,
One of the mountains,'

need to be supplemented by a mention of woodlands.

[1] The very frequent discovery of amber ornaments in round barrows may be fairly considered as an argument in favour of their 'Cimbric' or 'Baltic' origin. Mr. Spence Bate (see 'Trans. Devon Assoc.' 1872) considers the beautiful amber dagger-pommel found in a round barrow on Dartmoor as evidence for the 'Scandinavian' character of the interment. For amber-ornaments on bronze weapons, see Montelius, 'Congr. Internat. Anth. C. R. Stockholm,' ii. 833, and 'Catalogue, Stockholm Museum,' 1876, p. 40.

[2] 'Archaeologia,' 1870, xlii. p. 175, and supra, p. 255, note.

shire within the shadow of the protecting Forest of Wychwood, renders it exceedingly probable that this vigorous race, after surviving three centuries of Roman rule, may have endured till, at the commencement of the historical Danish invasion and immigration, there came into this country a stock to which they are beyond doubt physically, and probably also ethnographically, most closely allied.

The probable continuity in the way of descent of the long-barrow people with certain varieties of our present population, considered together with the fact that in these series we miss certain marks of degradation which are recognisable in the confessedly more ancient remains from certain continental 'finds,' may tend to produce in the mind of a reader an exaggerated as well as a somewhat mortifying notion of their inferiority in the matter of antiquity. I will therefore, in conclusion and very shortly, enumerate the various physical peculiarities of an anatomical, to the exclusion of an archaeological, kind which have in spite of all the considerations just put forward impressed me very deeply with a conviction of the immense distance which separates our time from that of the long barrows. First amongst these I should put the smallness of many of the skeletal and of the cranial bones both, which I have obtained from the long barrows alike of the cremation-kind, as in the East Riding of Yorkshire, and of the inhumation-kind in Gloucestershire. It is true enough that powerful skeletons and very large skulls have been found by me in these British as well as by many other investigators in many other interments of the same and of earlier ages. So generally accepted[1] indeed is this *a priori* surprising fact that we find writers such as Virchow ('Archiv für Anthropologie,' 1873, vi. p. 92) speaking of the notion that savagery and inferiority are characteristics of the aboriginal population of Europe as being simply an arbitrary preconception, 'der vorgefassten Meinung von der Wildheit und Inferiorität der europäischen Urbevölkerung.'

But against this criticism we have to set the following considerations; firstly, that the male skeletons in these tumuli are the skeletons of men who were chiefs, and chiefs in times and under conditions when such a position was held and kept only by men of force at once of character and physique (see supra, pp. 237, 260,

[1] See 'British Association Report for 1875,' p. 150.

ibique citata); secondly, that even in these 'tombs of the kings' we find (see supra, pp. 256, 258, 305) female skulls and female skeletons of disproportionate smallness; and, thirdly, that (see pp. 214, 249, 274 supra), mixed up in these tumuli with the large and well-filled male skulls, there are not wanting 'ill-filled,' 'boat-shaped' crania, to parallel which we have to go far afield amongst modern 'Natur-völker;' or that, in technical language, the crania of the neolithic period were not rarely dolichocephalic in a way which justifies us in speaking of them as being stenocephalic [1] and of their owners as being in contrast to modern civilised dolichocephali, 'angustiores' rather than 'latiores.' To the narrowness of the ill-fed brain the simplicity or obliteration of the sutures testifies often, even in the most fragmentary of the neolithic crania; in more perfect specimens we have the same conditions more forcibly impressed upon our imagination by the sight of the parietal and frontal eminences standing prominently out in relief upon the wall-sided and vertically-ridged cranium. If a contrast such as this can be shown to exist, between a series of what were all but certainly the crania of the most favourably conditioned and best developed of the neolithic population and any mixed series of later times

[1] Professor Aeby in 1863 ('Verhandl. Naturforsch. Gesell. Basel.,' iii. 4) proposed to divide all skulls into the two classes of Stenocephalous and Eurycephalous, having regard simply to the differences of breadth. In 1867, in his 'Schädelformen des Menschen und der Affen,' p. 32, he again argues that this division should be substituted for that of Retzius, according to which skulls are similarly divided into two classes, but into Dolichocephalous and Brachycephalous by reference to the relation subsisting between their length and breadth. His words are as follows:—'Was er (Retzius) also für lang und kurz gehalten ist nichts anders als schmal und breit, und es scheiden sich die Menschen nicht nach Dolichocephalie und Brachycephalie sondern nach Stenocephalie und Eurycephalie.' As there appears to be some tendency in recent writers, e.g. Zuckerkandl, 'Novara Reise,' 1875, p. 65, to adopt this classification, it may be well to say here that with dolichocephaly and brachycephaly respectively many more properties are correlated than those which their mere etymology connotes. Some of these are of primary morphological (see p. 233 supra), others of primary physiological (see p. 276 supra) importance. Neither is it possible to overrate the ethnographical importance of the fact insisted upon (pp. 189, 245, 260, 263, 264 supra) that within the circumscription of dolichocephaly and brachycephaly both, a natural subdivision may be made by reference to this very matter of breadth. There are 'ill-filled' brachycephalic skulls as well as 'well-filled;' 'well-filled' dolichocephalic skulls as well as 'ill-filled;' and to use, as is now sometimes done, the word 'stenocephalous' or 'schmalkopfige,' as convertible with dolichocephalous and as opposed to brachycephalous, is simply to ignore facts. These are excellently expressed by Professor Cleland's proposed quadrifid division of dolichocephali and brachycephali into 'latiores' and 'angustiores' respectively. See 'Phil. Trans.' 1870, p. 148.

down to this day from cemeteries in this country, the contrast would undoubtedly have been very much more sharply pronounced if we had had before us representatives of all classes from those early times.

Secondly, though well shaped and capacious calvariae with orthognathous upper jaws do abound in the series from the stone and bone ages, and after bearing a comparison, and by no means always to their own disadvantage, with modern specimens, may be only with difficulty distinguishable from them, the same can hardly be affirmed of that most distinctive bone, the lower jaw[1]. Enough

[1] The caves of Cro-Magnon and Mentone have furnished us with similar lower jaws from the palaeolithic men whose remains have been found in them, but, as in the cases of the Bushman and the Tasmanian, these lower jaws were combined with the low orbit so different from that of the Esquimaux, the wide opening of which in the skull contrasts so strikingly with the oblique, slit-like aperture of the eyelids in their living heads. And the prognathism of the Esquimaux, though it is possible to lay too much weight upon this point, as also the convex malar portions of the maxillaries, will be held by many to differentiate him from the palaeolithic and neolithic races both. On the other hand, Professor Broca ('Rev. d'Anth.,' 1873, ii. pp. 26–28), with the remains from the Caverne de l'Homme Mort before him, has no difficulty in connecting these neolithic with the palaeolithic men, and Professor Boyd Dawkins so long ago as 1866 (see 'Cave Hunting,' p. 359, ibique citata) collected a set of coincidences between the implements, works of art, and animal surroundings of these latter men and those of the Esquimaux, the number and variety of which it is difficult to explain except upon the hypothesis of some connection having subsisted between them. Colonel Lane Fox and Mr. C. E. Rance are cited in the 'Reliquiae Aquitanicae,' p. 284, as accepting and corroborating this view; and Sir John Lubbock at p. 262 of his edition of Nilsson's 'Early Inhabitants of Scandinavia,' whilst pointing out that Mr. Busk's identification of *Ursus priscus* with *Ursus ferox* gives us some additional 'reason for the belief that the Esquimaux once inhabited Western Europe,' uses language of a more cautious character as regards this conclusion than perhaps he might have done had not the author whose work he was editing expressed himself (pp. 104, 141) as being so very distinctly opposed to it. Mr. Alexander C. Anderson, 'Reliquiae Aquitanicae,' p. 49, and M. Sauvage, ibid. p. 220, would appear to be of the same opinion as Nilsson; most recent anthropologists, however (see for example Mr. E. B. Tylor, 'Primitive Culture,' vol. i. pp. 64, 95, ed. 1873, or the various authorities, old and recent, cited in the Address to the Biological Section, British Association, Liverpool, 1870, p. 103), incline to accept the argument from identity of custom to identity of race.

As regards the language of the Esquimaux, Professor Sayce has told us ('Contemp. Rev.,' April 1876, p. 722) that 'if we turn to the grammars of those savage tribes who best represent the infancy of mankind we shall find them marked by the greatest synthetic complexity. The involved and monstrous words of the polysynthetic languages of North America, where the Esquimaux *aglekkigiartorasuarnipok*, for instance, represents our "he goes away hastily and exerts himself to write," are really examples of those primaeval undecomposed sentences out of which the logical precision of a French grammar or the severe grandeur of a Semitic prophecy were eventually to come. Their cumbrous barbarism is due to poverty, not to profundity of thought.'

has been said above (pp. 242, 251, 252, 307) of the peculiar characteristics of the 'priscan' human lower jaw, of the tumid

Relatively to the Bushman language, however, the same authority writes in answer to an enquiry of mine: 'As regards phonology, the Bushmen with their clicks certainly stand on a far lower level than the Esquimaux. . . . . In some grammatical points, moreover, the Bushman language is what you aptly term "poor stuff." Thus the plural is denoted by reduplication, and the verb has not been developed. However, we do not yet know as much about the Bushman dialects as is desirable. Where the Esquimaux—like most of the other inhabitants of the Old World—best represent the primitive condition of speech is in the structure of the sentence. The independent word has not yet been evolved out of it.'

I have above (p. 229) expressed my feeling of the strain which is put upon the imagination by the effort to think even of the neolithic races as genealogically connected with the palaeolithic; and a still greater effort is of course required for putting in thought any still existing races into a similar relationship. The exertion necessary will however become lighter in proportion to the hold which the uniformitarian doctrines of modern geology obtain upon our minds, and in the meantime what is going on in the world at the present day may teach us that it has not always been easy, and may sometimes, even now, be impossible, entirely to extirpate a wild race of men in a wild country. Such were of course the men and the country of the cave and other palaeolithic periods. Neither, I apprehend, is it meant by speaking of affinity as existing between these ancient races and the modern Esquimaux, that these stone- and bone-using men are to be connected together at all in the same way as the Massaliotes were connected with the Phocaeans, or the Galatians of Asia Minor with the Gauls. No one supposes that an immigration has ever taken place from the district inhabited by the Esquimaux into the regions now occupied by the French, English, and Belgians. Nothing that is suggested by the facts goes beyond making us suppose that those countries were in the times in question occupied by a race of very considerable uniformity of physical structure, of habits, and of appliances for fighting their hard battle of life; and that the great changes which have since those 'unhappy far-off times' taken place alike in their inorganic and organic environment have broken those tribes up into fragments, of which some infinitesimal traces are perhaps still detectable amongst us, and of which the still widely-spread Esquimaux may, however altered in the course of ages, be with some probability held to be the most characteristic remnant.

I take this opportunity of drawing attention to two instances of the tenacity with which certain customs and practices have maintained themselves amongst some of the races which we have had under comparison, leaving to the reader the task of deciding how far such persistence may be explicable upon the principle *τὰ κακὰ συνάγει τοὺς ἀνθρώπους* (Arist. Rhetor., i. 6. 22), that community of needs and distresses brings all men together, and makes all men alike. First of these, as being less amenable than the other to the objection just referred to, I will put the singular aversion to fish as an article of food which has characterised certain of the inhabitants of Scotland from the time of Severus down to our own day and has been noted as something remarkable in the history of the modern Esquimaux. Dio Cassius (fl. A.D. 230), lib. lxxii. 21, p. 866 c, ed. Leunclavii, observes with the surprise not unnatural to an Italian, that the two most powerful British tribes, the Maeatae and the Caledonii, though they have no agriculture, but are dependent upon the produce of pastoral and hunting life and fruits, such as nuts and acorns, make nevertheless no use of fish for food, though fish are available in countless and inexhaustible quantities: *ἔκ τε νομῆς καὶ θήρας ἀκροδύων τέ τινων ζῶντες, τῶν ἰχθύων ἀπείρων καὶ ἀπλέτων ὄντων οὐ γεύονται.* Logan, who in his work on the Scottish Gael (vol. ii. p. 125) says that Herodian, a contemporary of Dio Cassius, makes

horizontal segment corresponding to its molar teeth, of its wide ramus, of its short coronoid process, of its feeble chin, of its rounded,

the same observation, a statement which I have not been able to verify, writes (l. c.) as follows of the modern Highlanders:—'The Highlanders, notwithstanding the mention of fish in several old poems, certainly did never willingly make use of such food. It was a matter of astonishment to an English resident among them a century ago that the trout with which their streams were teeming remained entirely disregarded, but they retain a proverb which implies their contempt for fish-eaters, and the encouragement of government has not yet induced either the Scots, Welsh, or Irish to enter with spirit into the fish trading.' Later evidence is not wanting to the same effect.

The same peculiarity is recorded by Mr. Whymper in the 'Alpine Journal' of May, 1870, with the same indications of surprise, as distinguishing the Esquimaux:—'Fish are plentiful on most parts of the Greenland coast, particularly cod, holibut, and salmon. But, although their quality is little, if at all, inferior to the best we can obtain in this country, the Greenlander does not care for them, he will eat them and does eat them, but he will seldom do so unless there is a great necessity. . . . . It is certain that in his heart of hearts he cares for none of them as food.'

Neither modern research among still existing savages (see 'Reliquiae Aquitanicae,' p. 95) nor ancient literature justifies the scepticism which has been expressed (see Sturzius in ed. Dio Cassius, 1824, vol. vi. p. 812; Selden, 'Mare Clausum,' ii. p. 127, ed. 1635) as to the abstinence from fish-food on the part of wild races living by the sea-side. Irrespectively of notices in the classical writers as to the prohibition of such food for religious reasons by Pythagoras, or in the cases of priests as in Egypt (Hdt. ii. 37), or as in the service of the Bona Dea (Julian, pp. 176, 177, ed. Lipsiae, 1696), we have such abstinence on the part of early races repeatedly mentioned by them as a matter of wonder and contrast. Marsham ('Can. Chron.,' Leipzig, 1676, p. 220) has improved upon the well-known remarks of Plato ('Rep.' iii. 404, or Trans. Jowett, ii. p. 231) and of Athenaeus ('Dipnosoph.' iv. p. 157, ed. Leyden, 1612), following Meleager of Gadara, to the effect that the warriors of the Iliad did not eat fish, by pointing out that the same may be said of the luxurious Phoenicians and the Ithacan suitors of the Odyssey, and that it was only under the pressure of necessity that the sailors of Ulysses betook themselves to fishing (Od. xii. 329-331):—

Ἀλλ' ὅτε δὴ νηὸς ἐξέφθιτο ἤϊα πάντα,
Καὶ δὴ ἄγρην ἐφέπεσκον ἀλητεύοντες ἀνάγκῃ,
Ἰχθῦς ὄρνιθάς τε, φίλας ὅτι χεῖρας ἵκοιτο.

Similarly the lines of Horace (Sat. ii. 2. 46-48),—

'Haud ita pridem . . . . .
Tutus erat rhombus tutoque ciconia nido,'—

and those of Ovid (Fasti, vi. 173-179) show that even in the times of Augustus a tradition remained of the period when fish and fowl were not used in supplementation of mammalian meat, when 'Piscis adhuc illi populo sine fraude natabat,' though 'Sus erat in pretio.'

The second peculiarity which I wish to note is one recorded by the ancient Strabo (iii. 4, 16) and by his contemporaries Diodorus Siculus (v. 33) and Catullus (xxxv, xxxvii) as distinguishing the Iberians and Celtiberians of their time; and by the modern Egede ('Description of Greenland,' second edition, London, 1818, p. 127; French edition, 1763, p. 98, cit. Sir John Richardson, 'Polar Regions,' 1861, p. 304) as distinguishing the Esquimaux; and it may be best given in the words of the first-named of those authorities:—(Οἱ Ἴβηρες οὐ) πρὸς διαγωγὴν ἀλλὰ μᾶλλον πρὸς ἀνάγκην καὶ ὁρμὴν θηριώδη μετὰ ἔθους φαύλου ζῶσι . . . . εἰ μή τις οἴεται πρὸς διαγωγὴν ζῆν τοὺς οὔρῳ λουομένους ἐν δεξαμεναῖς παλαιουμένῳ καὶ τοὺς ὀδόντας σμηχομένους καὶ αὐτοὺς καὶ τὰς γυναῖκας

often inwardly bent angle; the outcome of the investigation may be summed up by saying that though lower jaws combining all these marks of degradation may be found amongst such races as the Bushman, the Tasmanian, and the Melanesian, it is only amongst the Eskimos that we find such jaws combined with the widely open orbit and vertically elongated nasal cavity so characteristic of the long-barrow race. And there are many reasons for supposing that the Eskimos are a race which still retains and preserves for us in the structure and grammatical peculiarities of its language, its life-history, and physical peculiarities, the very closest likeness to what we believe some of the earliest races of mankind must have been.

The disproportion which I have dwelt upon (p. 256 et seqq. supra) as existing between the male and female limb- and trunk-bones from the long barrows is a striking feature in the comparison of that series with any other from later interments in this country. This however is a skeletal character reproduced in and reproducible by modern savagery. But the 'platycnemy' or peculiar flattening out of the shin-bones, which we know from the researches of Professors Busk and Broca and others to have characterised other early and earlier races of men, has stronger claims to be considered a note of antiquity; it is possible that such tibiae may be hereafter found amongst modern savages; but they will not, I anticipate, be found amongst such races in the numerical proportion to normal bones which I have found them to possess in neolithic skeletons.

αὐτῶν, καθάπερ καὶ τοὺς Καντάβρους φασὶ καὶ τοὺς ὁμόρους αὐτοῖς. The words ἐν δεξαμεναῖς παλαιουμένῳ are explained by the information that the 'liquor is kept in tubs in the porches of their huts for use in dressing the deer- and seal-skins.' It is clear from Catullus's use of the word 'mane' (xxxvii) that he did not understand the rationale of the process he refers to, and that he was inaccurate as well as otherwise offensive.

XVII.

APPENDIX TO THE ACCOUNT OF THE CRANIA OBTAINED FROM BRITISH BARROWS.

I HAVE thought it well to put together in an appendix a few remarks upon the flora and fauna of the prehistoric times with which I have been dealing, with the view of supplementing rather than of summarising the already existing and very extensive literature of this subject. Having had numerous opportunities of examining, not merely the collected contents of barrows, but the barrows themselves whilst still containing them *in situ*, I have come to feel that the history of the prehistoric flora and fauna may have been somewhat analogous to that of the barrows themselves, and may therefore receive some elucidation from it. Firstly, the barrows survive mainly in parts of the country into which agricultural improvements with their levelling tendencies have not penetrated as thoroughly as they have into less rugged, less hilly, more arable districts. But the same causes which have allowed these sometimes large masses to remain undisturbed may be reasonably supposed to have been equally favourable to the living organisms which were their contemporaries. Secondly, when we come to look at the structure of the barrows in various parts of this country and the character of their manufactured contents, we are impressed with the existence in them of a similarity and uniformity the more striking as it is not paralleled by any very marked similarity in the analogous human creations of the present day; whilst it is reproduced more or less closely in the flora and the domesticated fauna of those localities. The sheep, oxen, and swine of the Scotch and Welsh highlands, even if not as closely alike as are the horned cairns of Caithness, of Gloucestershire, and of the Peninsula of Gower (see p. 303 supra and Article XVIII), are nevertheless far from dissimilar; vegetable being more dependent upon inorganic influences than animal life, the flora at present in occupation of those districts may perhaps, when we make allowance for very recent disturbances in the way of planting, be held to be even as exact a reproduction of that which occupied them in neolithic times as the pottery of that period found at one end of this country is of the contemporaneous

pottery found in the other. If we are to reason about these as we do about other facts of distribution in space and time, we must hold that a greater uniformity existed in the forms of vegetable and a much greater in the forms of animal life over the whole of this country in prehistoric than in recent times; and that the districts in question may be likened to islands which have been separated from each other by the encroachments, sometimes more, sometimes less gradual, of an invading sea. If a greater mass of material has been available to me in the barrows themselves than has been to some other writers upon the subject of the fauna of prehistoric times, it must be said on the other side that my investigations have been confined to the 'houses of the dead;' and that I am not here writing of the relics to be found in such greater abundance in what were 'the houses of the living,' viz. cave- and pile-dwellings. In the largest long barrow indeed, that at Crosby Garrett (see p. 510 'British Barrows'), which I have examined, I noted that of all the animal bones found, only one single fragment could be said to have been proved to have owed its introduction to the race which reared the barrow. And though in many barrows considerable numbers of such bones have been found, the remains of the funeral feast have not been so productive, as indeed they could not have been expected to be, as the rubbish-pits or the floors of the dwellings of ancient times have been to other investigators.

I. Of the Prehistoric Flora of this Country in the Neolithic Period.

The palaeolithic man had before his eyes a country, the hills, valleys, and plains of which had somewhat different contours from those upon which the neolithic man lived his hunting or pastoral life. But the position of the long barrows and forts, reared by the later race of men in places of vantage as regards prospect and elevation, shows us that the solid earth on which they trod has had its escarpments and its river-courses subjected to but little change since their time.

The landscape however upon which his eyes rested was nevertheless a very different one from that which meets ours now in any but the wildest districts of this country. The characters of a landscape at various periods depend mainly upon its vegetation, and if the indigenous trees of Great Britain have not been so entirely out-numbered and the character of its summer and indeed winter clothing of leaves so entirely changed by foreign immigrations, as Victor Hehn in his interesting work, 'Kulturpflanzen und Hausthiere,' 1870, pp. 2, 314, 392, is in-

clined to think that of Italy has been, the changes which the woodlands of this country have undergone since prehistoric times have been very great indeed.

Much weight must in the first place be laid upon the enormously greater proportion of the entire surface of the country which was in early times occupied by trees, though England is even at the present day one of the best wooded of civilised countries; for the influence of this quantitative difference upon both man and beast must have been important and many-sided to a degree which, in spite of all that has been written by others, it is difficult to exaggerate. Qualitatively the character of the trees which filled the plains, clothed the hillside, and formed the sky-line of the neolithic period was a very different one from that of those which stand at intervals in our hedges and enclosures and bound our horizon, at least in our midland and southern counties. Some difference of opinion exists among botanists as to whether the 'common' elm, which is now perhaps the most abundant of our southern and midland trees, is or is not indigenous[1]. I cannot but think that the facts of its absence from parts of Great Britain which are separated either by moorland or mountain from the southern and midland counties, whilst it flourishes in such districts when once introduced into them, coupled with the fact of its rarely seeding here, should incline us to the latter view. It is obvious, as has often been suggested, that the Romans who introduced the vine may have introduced with it the 'piller' elm,

[1] For the changes which have been produced in our indigenous flora by the successive immigrants into or conquerors of this country, see De Candolle's Géographie Botanique Raisonnée, 1855, vol. ii. pp. 645–705; the Rev. C. A. Johns, 'Forest Trees of Great Britain,' who says (p. 42), 'If in my history of forest trees I were to confine myself to those which are universally acknowledged to be indigenous to Britain, I should soon bring my labours to a close. England, though once a well-wooded country, never probably could boast of containing within it any great variety of species;' and Pearson, 'Historical Maps of England,' 1869, pp. 48, 49.

For the question as to the indigenous character of the common elm, see De Candolle, l. c., p. 690, and Watson and Bromfield, citt. in loco; Pratt, 'Flowering Plants and Ferns of Great Britain,' vol. iii. p. 98; Johns, l. c. p. 227. The history of the common elm, which, though multitudinous and prominent in our landscapes, has yet failed, as its rarely seeding shows, to become really naturalised in our soil, may be taken as corresponding, and curiously, if it be really a Roman importation, to that of the Latin element in our language, which, though outnumbering by mere words the Teutonic or Saxon element in the proportion of 29,354 to 13,330 (Thommerel, cit. Max Müller, 'Lectures on the Science of Language,' 1861, p. 74), has never established itself in our grammar. The wych-elm, which in spite of its more rapid growth and greater beauty has nevertheless, owing probably to the lesser durability of its timber, had its area of distribution in Great Britain curtailed by successive invaders, may in like manner be considered to typify the history of the indigenous British races as encroached upon by Teutonic and Scandinavian conquerors.

the two plants being so commonly wedded in Italian husbandry, as in both Italian and English poetry. On the other hand, the readiness with which the wych-elm ripens its seeds, and its power of maintaining itself and flourishing even in the highlands of Scotland, to say nothing of its trivial name, the nationality of which is disputed, would appear to show that it at least is an indigenous tree; and it may consequently have contributed in larger proportions and given *pro tanto* a larger share of beauty to the prehistoric landscape than it does now to ours.

Dwellers on or near the chalk districts of England are too familiar with the conspicuous and beautiful, though common, seedlings of the beech not to feel considerable doubt as to the accuracy of Julius Caesar's statement that the tree though present in Gaul was wanting in Britain. Antiquaries who are familiar with the fact of the great abundance of the bones of the domestic pig in British barrows, both of the stone and of the bronze age, will find it difficult to believe that, in the latter of those periods at least, beech-mast and beech-trees had not been made available for feeding that animal; especially when they consider how freely intercourse was carried on between Britain and Gaul, and how easily the seeds in question could and would have been carried across the Channel. Botanists at least (see De Candolle, l. c., pp. 154, 689, and Johns, l. c., p. 144) appear to be agreed that the words 'Materia cujusque generis, ut in Gallia, est, *praeter fagum* atque abietem' ('De Bello Gallico,' v. 12) contain one of the few errors fallen into by Caesar. Had this statement related to Scotland it would probably have been correct, beech-mast never having been found any more than ash-seeds in the peat-mosses of Scotland, though both plants are now to be found even in the extreme north of that country, and though both, I think, must be held to be indigenous in South Britain.

For these considerations and some others seem to me to outweigh the views of Dr. Daubeny, expressed in 'Trees of the Ancients,' 1865, p. 7, to the effect that the beech 'was not known in Holland nor probably in England or Ireland at the time of the Norman Conquest;' views against which, as pointed out by Professor Pearson, l. c., p. 48, the mention of a 'bochholt' in a charter of Offa, and of 'the old beech' in one of the Confessor, can be urged as regards Saxon times. It is difficult also to reconcile them with the general fact stated by De Candolle, l. c., p. 689, on the authority of Davies ('Welsh Botany,' p. 90), that *dans le pays de Galles Ffa-wydden* (*wydden étant une désinence commune aux arbres et Ffa le nom proprement dit*) was the name for this tree; or with the special exemplification of this with which the Welsh name for Hereford, a city with beech-trees near it, '*Tre fawydd*,' furnishes us (see Camden's

'Britannia,' p. 476, cit. Professor Pearson, l. c.). As there is however no question that the beech fails to form any very large proportion of our South Britain peat-mosses, it may be suggested that this transference to the beech by the Welsh of a name which originally belonged to the oak (see Max Müller, 'Science of Language,' ser. ii. p. 236) must have taken place in a country where a preponderance had been gained by the former over the latter tree. If therefore Denmark was the country, see supra, p. 631, whence the bronze-importing invaders of this island came, the beech must have been a prominent tree there at an earlier period than is usually supposed[1]. Or it may have abounded here at that time and yet left, as in Denmark, no remains in the uncongenial peat.

By the word 'abietem,' Julius meant probably the *Abies pectinata*, s. *Pinus picea* L., our 'silver fir,' a tree with which, as being a Swiss, a French, and a Pyrenean pine, and climbing those heights in company with the beech, his campaigns in Western Europe had sufficiently familiarised him. The Scotch fir, *Pinus sylvestris*, was for many centuries later the only representative in these islands of the *Abietineae*, and

[1] As against the prominence, though not against the existence, of the beech in our own country at a much later period might be urged the fact that it is not mentioned by Chaucer in three places, 'The Assembly of Foules' (ed. Bell, 1855, vol. iv. p. 195), 'The Romaunt of the Rose' (vol. vii. p. 59), and 'The Complaint of a Lover's Life' (vol. viii. p. 8), where he does mention nearly all the other trees which in the fourteenth century entered largely into the composition of the English landscape; to wit, the 'oke,' the 'asshe,' the 'elme,' the 'boxe,' the 'firre,' the 'ewe,' the 'aspe,' 'notes,' s. 'philbert' (hazel), the 'bolas,' the 'pyn,' the 'maples,' the 'popler,' the 'lyndes,' the 'hauthorne.' And it might be said that in a Welsh poem ascribed to Taliessin, but referred by Professor Pearson (l. c. p. 48) to the fourteenth century, the beech and lime are both left unmentioned in describing a battle of the trees; and that the beech is omitted from a much earlier Welsh poem ascribed to Llywarch Hen in the sixth century. See Skene, 'Four Ancient Books of Wales,' i. pp. 279 and 576, cit. Pearson, l. c. As against the evidence furnished by a fourth passage from Chaucer, 'The Knightes Tale,' vol. i. ed. cit. p. 182, in which, as in Spenser's 'Faery Queen,' i. 7, 8, 9, the beech and also the birch and willow are added to the trees above enumerated, it might be objected that 'the whole description of the funeral and games is taken from the sixth book of the Thebais;' and as a matter of fact we have the words 'gli alti faggi' standing in the parallel passage, 'Teseide,' xi. 22, col. 237, ed. Ven. 1838. But Professor Earle writes to me upon this matter to the following effect: 'In the Knightes Tale, the marshalling of the trees in a catalogue is in manner Chaucer's own; and the majority of the trees, also, are his, and not Boccaccio's. . . . But as far as philological and literary evidence goes, it is all in favour of the trees being at Chaucer's time familiarly English. The word *beech* was ready to hand, and in its final form which has not since been modified. Yet that word was a considerable remove from the Anglo-Saxon *bóc*, and such modification postulates warm and constant usage. The word is ancestral, older, I mean, than our distinct national existence; it is so like in Anglo-Saxon to what it is in Icelandic and in German as to prove that there was no breach of continuity in its use from the earliest time.'

indeed the yew, *Taxus baccata*, and the juniper, *Juniperus communis*, the only other representatives of the entire natural order *Coniferae*[1].

In a round barrow at Kepwick examined by Canon Greenwell (see 'British Barrows,' p. 337) and myself the grave was found lined with the bark and branches of the birch; much as the Lapp graves, described in the 'Compte Rendu' of the Stockholm International Congress of Anthropology, 1876, tom. i. p. 181, or Mestorf's Report of it, 1874, p. 13, contained bodies entirely covered with several layers of birch bark sewed round them to protect them as much as possible. It is interesting to add that in these tombs, constructed of stones, and with much pains, 'on y a retrouvé . . . des pointes de flèche et des cuillers en bois de renne ainsi que des fragments de poterie . . .' and that 'quelques-uns des tombeaux renfermaient une ou deux pièces de bronze et de fer.'

Herr Victor Hehn has in two passages, l. c. pp. 11 and 425, laid so much weight upon the importance of the lime or linden tree (the 'lyndes faire' of Chaucer, *Tilia europaea, grandifolia*, and *parvifolia* of botanists) to man in early stages of culture, at once for the manufacture of matting, an invention of older date than weaving, and for the supply of honey to bees, to say nothing of its other uses, that in view of the indigenous character of the tree being disputed it becomes of importance to note that De Candolle (l. c. p. 658), with the arguments of Messrs. Leighton and Bromfield and with the philological evidence furnished by Davies ('Welsh Botany,' p. 53) before him, inclines to the affirmative side of the question. As regards the small-leaved lime-tree, *Tilia parvifolia*,

[1] The Scotch fir, *P. sylvestris*, must have met Caesar's eyes in great abundance in the parts of Britain which he traversed. Still he, not being a botanist, may have failed to recognise it as an *abies;* and it may, in the other countries in which he might have seen it, have been, then as now, overgrown and obscured by its natural allies. Or indeed it may have been represented in those regions at that time only by that dwarf marsh-haunting variety which, following zoological analogies, I would call *P. sylvestris*, var. *palustris*. The Swiss spruce, *P. abies*, on the other hand, which as much excels our English spruce in size and beauty as our Scotch fir excels the Swiss, may very easily have been confounded with the silver fir, *P. picea*, by Caesar, as when old it comes to resemble it both in general facies and in the colour of its bark. I have thought that the spruce may, like our common elm, have attained its present numerical preponderance in recent times and owing to man's help and its superior serviceability. And Dr. Uhlmann tells me it is less abundantly represented in the stone-period lake-dwelling of Münchenbuchsee than the silver fir. Dr. H. Christ, on the other hand, says the reverse is the case in the station of Robenhausen, which, according to Rütimeyer, 'Fauna der Pfahlbauten,' p. 161, bears other evidence of belonging to a later 'Kulturzustand.' For the geographical distribution of the *Abietineae*, see De Candolle, l. c., pp. 158, 190, 192; Fischer, 'Flora von Bern,' 1863, pp. 227, 228; Heer in Keller, ed. Lee, p. 349; Dr. Christ in Rütimeyer, l. c., pp. 228, 229.

the claims of which to be considered indigenous Mr. H. C. Watson ('Cybele,' i. p. 243) allows, it may be added that Mr. Edwin Lees (cit. Johns, l. c. p. 260) informs us that there is in the neighbourhood of Worcester a wood remote from any old dwelling or public road, of about 500 acres in extent, the greater part of which is composed of the small-leaved lime.

II. Of the Prehistoric Fauna of Neolithic Times.

But though the lime may have been available in these islands for the use of the bee, and though both the laws (Wotton, 'Leg. Wallicae,' i. 22, p. 43) and the literature (Sharon Turner, 'Vindication of the Ancient British Poems,' p. 59; Stephens, 'Literature of the Kymry,' 2nd ed., 1876, p. 80) no less than the reputation (Holinshed, 'England,' ed. 1807, i. 286) of the Welsh tell us that they made 'no less accompt' of metheglin or mead 'than the Greeks did of their ambrosia or nectar,' I should for several reasons be slow to think that the bee was domesticated in this country before the Roman era, or that the Celtic mead was made of any but wild honey. If we consider however, firstly, that even by the Romans themselves sugar was mainly procured from honey, beet-root and maple-sugar being wholly unknown and cane-sugar having been heard of only in some tradition from the expedition of Nearchus ('Strabo,' xv. 1. 20); and, secondly, how largely now separated sugars[1] enter into the dietaries even of the poorest amongst us, we shall come to see that this at first sight trifling matter would, if we could transport ourselves back into the days even of Caractacus, constitute for us as constantly felt a difference between ancient and modern life as would the absence or extreme rarity of glass and coal. The only evidence which I have met with which may seem to show that the British in pre-Roman times obtained the honey which the authority I am about to quote calls an 'excellent succedaneum' for sugar, from hived bees rather than πέτρης ἐκ γλαφυρῆς of the Iliad (β. 88), the 'stony rock' of

[1] See address to the Physiological Subsection of the British Association by Edward Smith, M.D., F.R.S. Report, Bath Meeting, 1864, p. 110. 'Separated sugars were obtained by 98 per cent. of the farm labourers in England, 92 per cent. in Wales, 96 per cent. in Scotland, and 82 per cent. in Ireland; and the quantity per adult weekly was—England 7½ ozs., Wales 7¾ ozs., Scotland 5¾ ozs., and Ireland 4¾ ozs.; so that Wales occupied the head, and Ireland the foot of the list, both in frequency and quantity. Of in-door operatives, silk-weavers obtained 7½ ozs., needle-women 7¼ ozs., kid-glovers 4¼ ozs., shoemakers 10 ozs., and stocking-weavers 11 ozs.; and hence the average was higher than that of out-door labourers, as 8 ozs. to 6·6 ozs. The frequency with which they were obtained was the same in both classes on the whole average.'

Scripture[1], or the mountain oak of Hesiod's 'Works and Days,' 230, is the following passage in Mr. Logan's 'Scottish Gael,' ii. 147. 'The Celtic Britons,' says this authority, 'kept their bees in a bascaud formed of willow plaited. About fifty years ago one of these was found in Lanishaw Moss; and about eighteen years since another was discovered about six feet underground in Chat's Moss, both in Lancashire. This last was a cone of about two yards and a half high and one yard in diameter at bottom, and was divided into four floors or separate hives.' No references are given *in loco*, and I have not been able to find any more detailed account of this discovery elsewhere. The older editions of Sir Charles Lyell's 'Principles of Geology,' e.g. ninth edition, 1853, chap. xlv. p. 721, familiarised us with the belief that Roman roads were to be found in Yorkshire and Kincardineshire covered under peat of eight feet in thickness; but in his tenth edition of 1868, vol. ii. chap. xliv. p. 499, as also in his 'Antiquity of Man,' 1863, p. 110, we find some distrust expressed upon this point, and in the last cited work the author inclines to accept M. Boucher de Perthes' estimate of three centimètres being the rate of increment for every hundred years. The following summary, however, of the facts known as to the growth of peat, given by Professor McK. Hughes in a lecture delivered before the Royal Institution, Friday, March 24, 1876, on 'Geological Measures of Time' (see 'Proceedings of the Royal Institution,' p. 6), will justify us in setting aside the imperfectly recorded history given above from Mr. Logan's work:—

'He explained the growth of peat, pointing out that there are two kinds of peat; that which is formed in water, as in mountain tarns or

[1] I have not been able to convince myself that there is any allusion in either the Old Testament or the Homeric poems to the invention of the hive any more than there is to the common fowl. The earliest mention of hives which I have met with is in Hesiod (fl. 700 B.C.), who in five lines of the Theogonia, 594–598, speaks of them twice, once in the words *σμήνεσσι κατηρεφέεσσι*, and again as *ἐπηρεφέας σίμβλους*. An eminent scholar has however suggested to me that hives seem to be referred to in the words from the description of the cave in Ithaca (Odyssey, xiii. 106):—

ἔνθα δ' ἔπειτα τιθαιβώσσουσι μέλισσαι.

But nothing that I can find recorded of the habits of wild bees is inconsistent with what we can see of the fearlessness with which swarms of our bees will enter places tenanted by man. As regards the force of the words, I find that Virgil in his paraphrase of the passage, Æneid, i. 159 seqq., as also Quintus Calaber in his vi. 470, omits to give any equivalent whatever for them, whence perhaps we may infer that they were not quite certain what they meant. Mr. Worsley however, in his translation of them, gives us the simple words, '*Wild* bees make honey there.' The two passages in the Iliad, ii. 87–89, xii. 167, obviously refer to wild bees; and I submit that Quintus Calaber in his line iii. 222, *αἵ ῥά θ' ἑὸν περὶ σίμβλον ἀπειρέσιαι ποτέονται*, as well as elsewhere, was guilty of an anachronism.

old river-courses, and the peat that grows all over the slopes of moorlands, high and low. The first is partly formed from drifted vegetable matter in the deeper parts, and from the decay of plants that grow on the spot all round the margin, which therefore encroaches rapidly. Here at the outset we meet with a source of error. The rate is very different in these two cases, the quantity of vegetable matter that drifts far in being generally very small. On the hill-sides the growth is to be referred almost entirely to two or three species of moss, and in a smaller degree to the heather and other plants. As the lower part of the mosses *sphagnum* and *hypnum* decay away and add to the layer of peat below, the upper part grows on, and so a thick layer of vegetable matter is at length accumulated. Workmen tell us that when they have dug a trench into a peat-moss, if they leave it alone it fills up again, or, as they would say, the peat grows again. This happens when the peat is apt during some seasons to be full of water, so as to become a kind of slush or ooze. It is perfectly clear that the apparent rate of accumulation where such filling in occurs must often be deceptive. A good example of a similar thing happening on a large scale in nature is the case of the Solway Moss, and many other instances as recorded by Lyell.

'So we see that while the peat is being formed it is subject to all kinds of variations, and when it has been formed it is liable to be soaked with water and run, destroying the value of all evidence to be derived from any observation on its rate of growth elsewhere.'

On the other hand, my own excavations in Roman rubbish-pits have furnished me with something of an argument to set against the reported discovery of hives under peat. When excavating in 1868 ('Archaeologia,' xlii. p. 476, Article XXXIV.) a very large pit of that kind at Frilford, I was much struck with the relatively great abundance amongst the various kinds of earthern vessels there represented by larger or smaller fragments of small, often nearly perfect, pots of hard black ware of about the size of a large swan's egg, with the smaller end truncated and flattened and the larger usually provided with a recurved lip for tying a cover over its contents. Now I have never found any of the various and well-known varieties of Roman funeral ware in a Roman rubbish-heap; every article of daily life, of the coarsest and of the finest kind, whether in pottery or metal, may be found in such deposits; but within my experience they never contain anything which was destined for the tomb or could bring to mind the 'invisas cupressos.' It is obvious however that such jars might be supposed to be intended for the cosmetic rather than the culinary needs of the luxurious Romans. But for the purposes indicated by Horace (Od. iii. 29) and Persius (Sat. iv. 37), for the

'balanus capillis' and the 'balanatum gausape,' finer ware than that of these diminutive amphorae would, I think, have been used, for finer ware is usually present in abundance in such collections, and was, as I have noted, l. c., specially abundant in the case specified; whilst, as was pointed out to me by Mr. Wm. Hatchett Jackson, of the University Museum, small jars of much the same contour, if not of the same paste, are still largely used in the honey trade of Narbonne. The sale of honey was amongst the 'patrias artes' of the Ligurian of the times of Diodorus and Strabo [1], and fashions and patterns which have once been in vogue in such trades are often very persistent.

Strong evidence of the literary and historical kind (q. v.) is brought forward by Mr. J. Thrupp, in his interesting article on the 'Domestication of Animals in England' ('Trans. Ethn. Soc. London,' 1865, New Series, vol. iv. p. 169), in favour of the conclusion that 'in the sixth and seventh centuries bees were altogether wild' in this country. The history of the words used for 'hive' appears to show that the first step towards the domestication of the bee by the English was 'the formation of imitations in bark (*rusca*, see Ducange, *sub voc.*) of the hollows of the trees in which they were found.' About the middle of the tenth century we read of Anglo-Saxon 'beo-churls;' and we find 'the Anglo-

[1] Diodorus (v. 34) writes thus of the Celtiberians (in the connection already referred to, p. 635 supra): *Τροφαῖς δὲ χρῶνται κρέασι παντοδαποῖς καὶ δαψιλέσι καὶ οἰνομέλιτος πύματι, χορηγούσης τῆς χώρας τὸ μέλι παμπληθές.* It may be an overstraining of the words to suggest that the six last quoted may be considered to indicate that wild rather than hive honey was in the mind of the writer. The words of his contemporary Strabo are in a parallel passage (iv. 6, 2, p. 168, ed. Müller, 1853) to the following effect:— *Λίγυες, ζῶντες ἀπὸ θρεμμάτων τὸ πλέον καὶ γάλακτος καὶ κριθίνου πόματος, νεμόμενοι τά τε πρὸς θαλάττῃ, χωρία καὶ τὸ πλέον τὰ ὄρη . . ὕλην παμπόλλην ναυπηγήσιμον καὶ μεγαλόδενδρον . . . κατάγουσιν εἰς τὸ ἐμπόριον τὴν Τένουαν καὶ θρέμματα καὶ δέρματα καὶ μέλι . . . πλεονάζει δὲ καὶ τὸ λιγγούριον παρ' αὐτοῖς ὅ τινες ἤλεκρον προσαγορεύουσι.*

M. Escher vom Berg, 'Mittheil. Ant. Gesell. Zurich,' Rapp. vi. Pfahlbauten, p. 34, suggests that the straining of honey off the comb may have been the use to which were put such perforated dishes as that figured by Keller, l. c., taf. v. fig. 26, p. 270, or ed. Lee, pl. lii. B, fig. 1. See also Désor, 'Le Bel Age du Bronze,' p. 12, fig. 22, and Schliemann, 'Trojanische Alterthümer,' tab. 174, fig. 3377. Usually such perforations are held to have been intended for filtering whey off curds, in accordance with the Homeric words, Od. ix. 222, 223:—

Ναΐον δ' ὀρῷ ἄγγεα πάντα
Γαυλοί τε σκαφίδες τε τετυγμένα.

But we may suppose that in such descriptions as this we have traditions of a much earlier period than those we are here concerned with, preserved for us. It is right however to add that Herr Edmund v. Fellenberg, 'Bericht über die Pfahlbauten des Bielersees, S. A. 1875,' pp. 55–61, suggests yet another application, that of fumigation, for these vessels. Honey however is so strained in certain Swiss valleys at the present day.

Saxon word "beo-cist" (bee-chest) and the Latin "alvearia" (bee-hives) usually substituted for "rusca," from which it may be inferred that these rough constructions were superseded by regular hives.'

Hehn ('Cultur-Pflanzen und Hausthiere,' p. 425 ed. i, p. 505 ed. ii), referring to an 'erschöpfend' article by Pott in Kuhn and Schleicher's 'Beiträge,' ii. 265, in which the Slavonic word for hive is stated to be *ulei* and the Lithuanian *awilys* (as according to Grimm (1819) the Bohemian word is *aul* and the Polish *ul*), suggests that these words may be loan words modelled from the Latin *alveus*, and mediaeval Latin *apile*. The Welsh scholars in Oxford, the late Principal of Jesus College and Professor Rhys, inform me that the common Welsh word for bee-hive is *cwch-gwenyn*, literally boat of bees, and that these are not loan words. If the words are not borrowed words, the idea which they express is borrowed, and shows that the employers of the metaphor used boats before hives. If the boats to which they compared the beehives were the North Welsh coracles with 'subspheroidal' rather than so-called 'scaphoid' outlines, this may further indicate that the earliest form of beehive with which the Welsh were acquainted was one which was late to be attained to in the development of the invention[1]. If we are right in holding, on the authority of Logan, l. c., that the Cornish word for hive is *kauelh*, which in Welsh means a large basket, this would go some way to show that the Cornish were not acquainted with, or at least did not adopt the hive until it had been developed beyond the stage of 'rusca,' 'corticibus suta cavatis,' into that of the 'lento alvearia vimine texta' of Virgil. I have, finally, the authority of Professor Rhys for the possibility of the Welsh word for wax, viz. *cwyr*, being a loan word from the Latin.

I searched, as I had expected, in vain, for any figure of a hive in Mr. Evans's[2] 'Coins of the Ancient Britons,' 1864.

[1] I learn from Professor Westwood that according to Spinola our domestic species *Apis mellifica* rarely occurs in Liguria; and he suggests that this shows either that the Ligures were not the colonisers of Wales, as has been affirmed, or that they did not bring their bee, *Apis ligustica*, with them.

[2] In answer to an enquiry of mine as to the existence of a figure of a hive on any ancient coin whatever, Mr. Evans informs me that he does not know of any such coin which has certainly a hive upon it. The figures upon two coins of Dyrrachium given by Beger ('Thesaur. Brandenberg. Select.' vol. i. p. 459) and by Goltz (ed. Nonnius, 1620, pl. i. fig. 7, p. 4) amongst the coins of Greece, the Islands, and Asia Minor, though described locc. citt. as 'apiaria' and 'alvearia,' Mr. Evans thinks may be merely the caps of the Dioscuri. And to me these figures, as given in the latter of the books referred to, appear with their pendent strings to suggest the 'mitrae' with 'redimicula' of the Æneid, ix. 616, rather than the 'alvearia' of the Georgics.

Professor Westwood has furnished me with certain references from hagiological

The currently, and as I believe correctly, accepted view that the common fowl, *Gallus gallinaceus*, is never mentioned by, and may with some considerable likelihood be supposed to have been unknown to the Old Testament writers and to Homer and Hesiod also, is confirmed by the negative evidence of the neolithic interments in this country[1].

literature which bear on the question of the recent date of the domestication of the bee in these islands. In the Life of St. Cadoc (Bibl. Cotton. Vesp. A. xiv.) it is stated that he chose a solitary place for his monastery, having seen 'aprum sub arbore jacentem, apes venientes et intrantes in cavam arborem.' In the first Life of St. David we read that his father was told by an angel that he would find gifts by the river Teivy; a certain stag; 'apumque examen in arbore positum,' &c. And in the second Life of the same saint there is a curious legend of a swarm of bees settling on a ship going to Ireland, the bees following St. David from place to place; and it is added that 'Hibernia in qua nunquam usque ad illud tempus apes vivere poterant mellis fertilitate ditatur.' See also Lanigan, 'Eccl. Hist.,' iii. 82–84; 'Life of St. Molaga,' cap. 22; 'Notes on Irish Architecture,' by the Earl of Dunraven, i. pp. 63, 64.

[1] It is a little difficult to reconcile the passages which stand in our authorised version of the Old Testament (1 Kings x. 22; 2 Chron. ix. 21), to the effect that a navy of Tarshish brought 'once in three years gold and silver, ivory, and apes and peacocks' to king Solomon, with the view held, I should suppose, by most modern Hebraists, as by Bochart ('Hierozoicon,' ed. 1682, lib. i. cap. xvi. p. 111), that when the Latin 'interpretes multa prophetarum loca ad gallinaceum genus referunt,' it is, in the words of the writer just cited, 'conjecturis non satis certis.' For the servants of Hiram and Solomon would have found it at least as easy and profitable to import *Gallus bankiva* and indeed *Sus indicus* as apes and peacocks. But as against this utilitarian consideration we may suggest that the words of Caesar quoted in the text render it not wholly improbable that to the Tyrian sailors the fowl may have been a forbidden food, as it was to many other races; and as, in fact, *Sus* was to their Hebrew comrades on those ships of Tarshish. Antiquaries who hold that it was from intercourse with Phoenician rather than with Etruscan traders that the Britons learnt certain other things will think this an argument in their favour. A long sea-voyage however, as the absence of the fowl from New Zealand in the time of Captain Cook shows us, made the introduction of domestic animals very difficult to such navigators. And the history of the words makes me suspect that it was by the way of Babylon rather than that of the Red Sea that the peacock itself, to say nothing of the common fowl, the *περσικὸς ὄρνις*, found its main route of immigration into Palestine and Greece. For, during the Babylonish captivity the word *tukhi-im*, the Hebrew representative of the Malabar name for the peacock, had become obsolete, and, like many other Hebrew words, was nearly forgotten in the time of the LXX, who have given what the Targum, using a word, *tavas*, almost identical with *ταῶς*, holds to be its true meaning, only once and in a various reading (Cod. Alex.), *καὶ ταώνων*. And Minayeff (cit. Caldwell, 'Dravidian Grammar,' ed. 1875, p. 92) has discovered in the Buddhistical writings that the ancient Indian merchants took peacocks to Babylon. Probably the fowl was carried with them.

As regards the absence of any mention of the common fowl in the Homeric poems, I have been told that an eminent and voluminous writer upon this subject is of opinion that in the line, Il. vi. 513,

Τεύχεσι παμφαίνων, ὥς τ' ἠλέκτωρ, ἐβεβήκει,

we have Paris, in his ill-supported character of warrior, compared to this bird. A somewhat similar passage in the Proverbs of Solomon (xxx. 31) has been similarly

Negative evidence is perhaps stronger in this case than in most of the others in which I have had to refer to it. For it is difficult to think on

misconceived of; and it is true that we do find this comparison used by Æschylus ('Agamemnon,' 1671) for a man with a character not wholly unlike that of Paris. This however proves nothing. I have not enquired what the balance of commentatorial authority may be upon this point; for I cannot understand how any unprejudiced person who will compare the passage already referred to, Il. vi. 504–514, with the ten lines Il. xxii. 22–32, describing the armed Achilles, can doubt that the two passages are the work of one poet; that he uses in them two metaphors in illustration of one phenomenon; and that in neither of these metaphors is the bird in question alluded to. Theognis (fl. 540 B.C.) is the earliest Western writer, so far as I know, in whom any indisputable allusion to this bird has been found; and to him the cock crowing appears to have become already a familiar mark of the passing of time. We have also Payne Knight's authority ('Prolegomena,' ed. 1820, Paris and Strasburg, p. 3) for saying that in the same sixth century B.C. the coins of Himera and Samothrace bore evidence of its establishment in Mediterranean countries. See for coins, Goltz and Nonnius, 'Graecia, Insulae et Asia Minor;' Carystus, tab. xi. et xii; Massieu, p. 500; Rasche, 'Lex Num.' ii. 2. p. 311.

Whilst upon the subject of the importation of animals from the East Indies, I would draw attention to the fact that the area of the world's surface which M. Mortillet (in his most suggestive paper, 'Sur l'Origine de Bronze,' in the 'Revue d'Anthropologie,' 1875, iv. p. 653) has pointed out as the region in which the largest and most readily available deposits of tin were and are to be found side by side with copper, the region namely which extends from 'La Birmanie Anglaise' to the Sunda Straits, lies entirely within the area of distribution of the *Gallus bankiva* (see Sclater, 'Proc. Zool. Soc.,' April 21, 1863, p. 122), the undoubted parent stock of the common fowl. This coincidence appears to me to add something to the force of M. Mortillet's argument in favour of the East Indian origin of bronze; but it must be added, on the other side, that if the domesticated bird followed bronze westwards, this order of events was reversed in the easterly and south-easterly direction, the introduction of the bird having preceded all importation of metal into Polynesia.

So much has of late been written upon the Indian or African origin of our domestic animals, mammalian and avian, that it may be well to add in this connection that too much weight may in this question be given to the principle laid down by Link in his usually excellent though now old treatise, 'Die Urwelt,' 1821, i. p. 201, to the effect that the domestication of birds indicates a higher condition of civilisation than the domestication of mammals. The Indians described by Mr. Bates (l. c. supra) domesticate not only the common fowl which will, but curassows which will not breed in captivity; and the same authority is referred to by Mr. Francis Galton ('Trans. Ethn. Soc.,' 1865, New Series, vol. iii. p. 125) as having given him a list of birds tamed by the same tribes which is more extensive than the list of quadrupeds tamed by them, though that list contains twenty-one species. And this they do, at the same time that they 'do not show themselves so sensible of the advantages derivable from the ox, sheep, and hog, all of which have been introduced into their country.' Few Englishmen will be found to agree in Guizot's comparison ('Hist. Civ. Franc.,' lect. vii. tom. i, cit. Merivale, 'Conversion of the Northern Nations,' p. 185) of their Anglo-Saxon forefathers' condition, social and political, to that of the modern Red Indians; still as against Link's principle quoted above it is worth while to recollect that they, in the words of Mr. Thrupp (l. c. p. 172), 'kept as pets and probably attempted to domesticate' ravens, rooks, cranes, and peacocks.

the one hand as regards literature, that poetical writers would have omitted to use for illustration the habits and bearing and peculiarities of a creature which all later poets, gnomic and other, have so constantly and multifariously alluded to; and on the other as regards excavations, that an animal which Captain Cook found in occupation of Polynesia, from Tahiti to the Sandwich Islands, and which has since been adopted everywhere, even by the non-progressive Indians of the Amazons (see Bates, l. c., ii. 193), and 'by remote tribes on rivers rarely visited by white men,' would have been missing in them if it had existed on the spots at the period concerned. There is of course no question that the common fowl was known to if not used by the Britons when Caesar made his short acquaintance with them and found that 'Leporem et gallinam et anserem gustare fas non putant; haec tamen alunt animi voluptatisque caussa.' (See 'De Bello Gallico,' v. 12.)

Nor, on the other hand, does the discovery of the bones of *Gallus* as described by Alphonse Milne Edwards ('Reliquiae Aquitanicae, p. 241) in association with 'those of Ursus spelaeus, Rhinoceros, and large Felis' in the caves tenanted by palaeolithic man make it at all more likely that the bird has, any more than the mammals, been continuously represented upon that area since those times down to those of Caesar and ours. The struggle for existence with rival animals, to say nothing of that to be waged against inorganic forces, may well have exiled and exterminated during the neolithic age animals which the men of the bronze and iron have found it their pleasure or their interest to introduce again, or which may themselves have succeeded in reoccupying their lost territories. The history of the fallow deer, and possibly those of the rabbit and horse, might, if we could read them out of the records in the soil, illustrate this principle, just as the recent history of the capercailzie, *Tetrao urogallus*, does.

On the other hand, though M. Alphonse Milne Edwards (l. c., pp. 243–247) appears to think otherwise, I should incline to think that the Crane, *Grus cinereus*, may have occupied this country continuously from palaeolithic down to the comparatively recent period of its extinction here. Difference merely of size is not sufficient in this case to establish a specific difference. The bones of more than one specimen of this bird were found by two of my former pupils, Mr. W. Bruce Clarke and Mr. Randal Johnson of Pembroke College, in a rubbish-pit at Wytham, near Oxford, mixed up with the skeletons of three dogs, with bones of ox, pig, roe, horse, teal and wild-swan, and with coarse culinary nail-marked and other British pottery, by which the date of this 'find' is fixed to the bronze age. I have not met with any remains of this bird in any

excavations of an earlier date in this country; though it is difficult to think that neolithic man would have neglected it as an article of diet unless debarred by superstition from making use of it.

The rabbit, *Lepus cuniculus*, finds a place in several catalogues of British Prehistoric Mammalia; Mr. Pengelly, however, writing of the discovery of the cave man at Mentone ('Trans. Devon Association for the Advancement of Science,' vi. 1874, pp. 318, 801, 818, 840), says that the discovery of its bones in that deposit does 'not strengthen the evidence for its antiquity:' though there is of course no doubt that the remains of this animal, which still survives as a member of the fauna of North Africa, form an essential and not merely an accidental constituent in the quaternary deposits of Mediterranean caves (see Prof. Busk, 'Zool. Trans.' x. 2, p. 128), and though it is difficult to set aside the evidence of their holding a similar relation to some of our own caves. Professor Rogers, who in his 'History of Agriculture and Prices in England' has given us (vol. i. pp. 33, 65, 123, 340, 341, 583, vol. ii. 558–9 [1]) records of the high prices paid for these animals in the middle

[1] In Daniel's 'Rural Sports,' 1801, vol. i. p. 347, there is the following statement:—'In an account of the prices of provisions, &c. at the installation feast of Ralph de Borne, abbot of St. Austin's, Canterbury, A.D. 1309 (contained in the fourth volume of Dr. Henry's valuable History of Great Britain), we have among others the following articles:—

	£	s.	d.
600 rabbits	15	0	0
Partridges, mallards, bitterns, larks . .	18	0	0
200 pigs	5	0	0

As partridges are here associated with other birds and no mention made of their number, their price in these times cannot be ascertained, but a rabbit appears to have been sold at the same price as a pig, viz. sixpence each. Their relative value has considerably altered in the interval between that day and this.'

I should not agree with the view put forward (l.c. 341) by my friend and former tutor Professor Rogers, to the effect that rabbits when once introduced 'would spread very slowly over the country.' We have good natural history evidence, both direct and analogical, for holding that starting even from a single centre, and as individuals ranging only for short distances, they would form a circle with a very rapidly widening circumference in the absence or paucity of natural enemies. Literary evidence in the same direction is furnished by the beautiful lines of our fourteenth-century poet, Chaucer, in the 'Romaunt of the Rose,' ed. Bell, 1855, vol. vii. p. 60:—

'Conies there were also playing
That comen out of her claperes,
Of sondry coloures and maneres,
And maden many a turneying
Upon the freshe gras sprynging.'

So also in the 'Assembly of Foules,' vol. iv. p. 196, in a parallel passage of equal beauty we have the line

'The pretty conies to hir playe gan hie.'

Whence it would appear that the animal in question was a familiar object to English

ages, declares himself of opinion that 'rabbits were introduced into England in or just before the thirteenth century.'

I have never found the remains of the rabbit in any surroundings earlier than those of Saxon times; but difficult as it may be to prove the positive fact of the contemporaneity of a burrowing animal with a deposit into which it is possible it may have burrowed, it is more difficult still to prove the negative fact of its absence from an entire country at any one particular period. Further, the comparatively small size of the rabbit makes the matter still more difficult than it is as regards the fallow deer, or the elm and vine and chestnut, which we may speak of as having been probably introduced or reintroduced by the Romans. And, thirdly, as a much larger portion of Britain was occupied in earlier than in later times by woodland which would furnish protection and harbour to the *Mustelidae*, the martens, weasel, stoat, and polecat, the natural enemies and most effectual destroyers of the rabbit, we can understand how this latter animal has escaped the ordinary fate of *ferae naturae* and become more abundant in this country concomitantly with the increase of its human occupants, and the curtailment of its woods and forests[1]. The relations of the *Mustelidae* to the *Rodentia* generally are expressed accurately in the 'Batrachomyomachia,' 51–52:—

πλεῖστον δὴ γαλέην περιδείδια ἤτις ἀρίστη
Ἥ καὶ τρωγλοδύνοντα κατὰ τρώγλην ἐρεείνει.

The bones of water-rats, *Arvicola amphibius*, I have found lying in

eyes in those days. I take this opportunity of remarking that an acquaintance with the line next but one to that just quoted,

'The dredeful roe, the buck, the hart, the hind,'

would have made the suggestion that the fallow deer was introduced into England no earlier than the time of James I. an impossibility. For the introduction of the fallow deer into Britain, see Professor Boyd Dawkins, 'Proc. Geol. Soc. Lond.,' June 17, 1868, p. 515; 'Nature,' Dec. 10, 1874, Jan. 21, 1875; Jeitteles, ibid., Nov. 26, 1874; Sir V. Brooke, ibid., Jan. 14, 1875.

[1] From British coins the rabbit is as entirely absent as is the beehive; see p. 331 supra. Of Spanish coins, on the other hand, Spanheim ('De Praestantia et Usu,' vol. i. p. 179), in a passage pointed out to me by Mr. Evans, says it may be taken 'index velut ac tessera,' much as the dolphin is of Italian seaports and the owl of Athens and her colonies. Dr. Whitaker however, in his 'History of Manchester,' may overstrain the words of Varro (iii. 12), 'Et quod in Hispania annis ita fuisti multis ut inde te cuniculos persecutos credam,' by supposing them to show that the writer held that all rabbits in Italy had been imported from Spain. For a disquisition on the history of the rabbit, see Houghton, 'Ann. and Mag. Nat. Hist.,' 1869, iv. Ser., vol. xv. p. 179. For one on that of the martens, see 'Journal of Anatomy and Physiology,' 1868, pp. 47, 62, 437, 438 (also Article XXVIII.), where the historical relations of these animals to the rabbit, and also to the *Felis catus*, are considered.

great quantities in a barrow together with a few remains of the polecat, *Mustela putorius*, which latter animal had used the place as a lair and probably nest for a considerable period. The upper and lower jaws of the water-rats had been left intact, their strong teeth, which should have prevented what I am well assured were similar remains in other barrows from being spoken of as rats' bones, having been found over-resistent by their destroyers, who had however, with the characteristic instinct of their genus, never spared the brain-containing calvariae.

The dog has only rarely been met with in British interments either of the stone or of the bronze age, a circumstance worthy of note when we recollect how very commonly the dog has in all countries kept his master or mistress company in the tomb as faithfully as during life. One instance however of such an interment I noted and have described ('Journal Anth. Inst.,' v. p. 157; Article xviii.) in the neolithic barrow at Eyford; the dog had undoubtedly been buried together with a woman, whose skeleton was, like that of the dog, still partly *in situ*. The characters of the dog's skeleton, like those of many other objects found even in interments most undoubtedly of the stone- and bone-age, are such as, irrespective of any reference to what we know of palaeolithic times, to impress upon us the conviction that the men even of those far-off days had yet been preceded by many generations who had made-weapons and domesticated animals. This dog bears no resemblance to the wolf-like Esquimaux dog on the one side, nor to any such small terrier-like breed on the other, as might suggest that it represents a lately domesticated jackal. It may be conveniently spoken of, as Rütimeyer ('Fauna der Pfahlbauten,' p. 118) does speak of the dog, similarly rare in the relics from the Swiss lake-dwellings, as a 'middle-sized' dog, 'einen Hund von mittlerer Grösse;' a description which, however vague, is decisive as to its representing a long-domesticated breed. The lower jaw, the only part of the head which had been left undisturbed *in situ*, had the stoutness and was about the size of that bone as seen in some of the smaller English mastiffs; its trunk bones are still incomplete, but may be supposed to have made up the framework of a body about the size of that of an ordinary shepherd's-dog[1]. The

[1] The dog was abundantly represented in the Norfolk flint mines known as 'Grimes Graves,' and described by Canon Greenwell, 'Journal Ethnol. Soc.' 1870, p. 431. I do not know the size of the animals to which these remains belonged, but the ingenious argument which Rütimeyer has drawn from the supposedly uniform inferiority in size of the stone-age dog for the singleness of race of his human masters is invalidated by the discovery in the very early lake-dwelling of Luscherz by Dr. Studer of more than one race of dogs. See 'Bericht über die Pfahlbauten des Bielersees,' 1875, p. 24.

dogs of the bronze period referred to, supra p. 334, are about the same size.

In the same chamber with the bones of this dog a single bone of a fox, *Canis vulpes*, was found, which escaped notice when the contents of the chamber were first examined and described, l. c. Its texture and weathering are so similar to those of the other bones, human and canine, found in the chamber, as to suggest that it must have been nearly or quite of the same age; and its slenderness and slightness, as compared with those of modern foxes, illustrate the principle that the bones of the carnivora of times when game-preserving was unknown, and when they had consequently more of their own congeners to compete with and fewer of their victims available to prey upon, are smaller than those of our days when these conditions are exactly reversed. The bones of the martens and polecats which I have found in various barrows bear out this view. Similar facts have been noted by Rütimeyer in the 'Fauna der Pfahlbauten,' p. 231.

As in the earlier pile-dwellings of Switzerland, so in the stone-age barrows of this country, the horse is less frequently found than from what we know of the discovery of its bones in cave-dwellings on the one hand, and in interments of later date than the stone age on the other, we should be inclined to expect[1]. I have never found the bones or teeth of a horse in a long barrow, and I would remark that, whilst such bones are very likely to be introduced into such barrows in the way of secondary interments, I have not met with any exact record as to the finding of them in surroundings which left no doubt as to their being contemporaneous with the primary interments. The bones of the horse are both durable and conspicuous, and it is difficult to think that if the neolithic man had used the animal either for purposes of food or for those of carriage, as his predecessors and successors did, we should not have come upon abundant and unambiguous evidence of such use.

As regards the wild boar, *Sus scrofa*, var. *ferus*, I have to say that in this country, whatever has been the case elsewhere, it has been but rarely found in the barrows either of the bronze or of the stone period. Until indeed the discovery of it at Cissbury, as described in the 'Jour.

[1] For the history of the prehistoric horse, see Rütimeyer, 'Fauna der Pfahlbauten,' 1861, p. 122; 'Archiv für Anthrop.,' 1873, vi. p. 60; 1875, viii. p. 125; 'Veränderungen unserer Thierwelt,' 1876, pp. 69, 92; Naumann, 'Archiv für Anthrop.,' 1875, viii. p. 12; Merk, 'Excavations at the Kesserloch,' translated by J. E. Lee, 1876, pp. 9, 47, with figure; Dupont, 'Congrès Internat. Stockholm,' C. R. 821; Kinberg, ibid., p. 830.

Anth. Inst.,' vol. vi. (Article xix.), I have never met with its remains in any barrow, though the domesticated variety had been represented in several of both periods. Subsequently the tusk of a wild boar was found in the Nether Swell long barrow. The lower part of the horizontal ramus of the lower jaw of a wild boar found at Cissbury had been broken away, as has so often been noted in other instances, for the purpose of extracting the marrow; and the same practice had been put in force with the remains of two tame pigs found ('British Barrows,' p. 454) immediately behind the head of a female skeleton of the late Celtic period. The domestic British pig does not seem to me to differ in any important particulars from the races which we believe to be the descendants of the wild boar. Two bronze statuettes of the Gallo-Roman period given me by Mr. John Evans, as also many antique Italian terra-cotta figures, show that the Romans in Gaul knew both the long-snouted wild-boar-like breed and the shorter-snouted better-bred race. The same contrast is shown in two plates (pl. iii. 4, pl. v. 5) of Sambon's 'Recherches sur les Monnaies Antiques de l'Italie,' Naples, 1870, the former of which gives us a pig with a very long and slender snout, whilst in the latter, which represents a sow suckling three young ones, we have, together with the pendent ears, so usually though not invariably characteristic of domestication, the short snout bent upwards so as to form, as in our best breeds, an angle with the plane of the sagittal suture along the roof of the skull. Columella may be cited in support of the same view, as he (lib. viii. cap. 9) says that pigs with such short and recurved snouts were preferred to those of a different frontal profile; 'Quare in suillo pecore probandi sunt . . . rostri brevibus et resupinis.' But I have not found the skulls of this 'Cultur-Race' in British burial-places, and the tenacity with which very different races have maintained themselves in very many parts even of our less wild districts up to quite recent memory makes this the less remarkable. The figures of the boar upon coins and shields of the late Keltic period, i. e. from circa 200 B.C. to circa 80 A.D., might perhaps be taken as confirming the conclusion which my examination of the osteological remains (given at length in the 'Trans. Linnaean Soc. Zool. Series,' vol. ii. 1877, Article xxx.) had led me to, had they been more frequently and more distinctively than they are, figures of domesticated as opposed to wild animals. Still, what Mr. Franks writes ('Horae Ferales,' p. 188, pl. xiv.) is to the purpose in this connection, especially if we compare the plate referred to by him with plates vi, viii, xii, and xiii of Mr. Evans's 'British Coins.' Mr. Franks's words (l. c.) are as follows:—'The boar as seen on the Witham shield appears only on the older or autonomous

coins of Gaul and Britain; on Roman civilisation being introduced, this national symbol was no longer a gaunt lean animal, as it appears on the shield, but a well-conditioned boar of a natural form and in a classical attitude [1].'

The small Scottish Highland and Island breed of pigs described by Low ('Domesticated Animals of the British Islands,' Eng. ed. p. 429, Fr. ed. pl. iii) and by Youatt ('The Pig,' 1847, pp. 50–52) as having sharp-pointed suberect ears, remarkably strong muscular snouts, an arched back (the 'Carp' back of the Germans), and a forest of stiff bristles arising from it, may perhaps be taken as representing to us now what the ancient domesticated pig was. The old Welsh pig resembles the Scotch in various points characterising an unimproved breed, but its large ears, spoken of familiarly by breeders as being 'as large as newspapers,' indicate that it has been more thoroughly domesticated. Its colour also is more constantly and deeply dark than is that of northern form [2]. But the size of the ears and the colouration are both

[1] The following passage from De Blainville's 'Osteographie,' 1847, fasc. xxii. p. 170, may be quoted as being a good instance of the folly of relying in these questions upon negative evidence, especially when the existence of that evidence is due simply to neglect of the three lines of enquiry available here, viz. the examination of bones; the excavation or other discovery of coins and works of art; and, thirdly, the examination of literature. Writing of *Sus* he says, 'Du temps de César il paraît cependant qu'elle n'était pas encore parvenue dans les Gaules, car il n'est nullement question de cet animal dans ses Commentaires; elle s'y est donc propagée depuis la conquête, d'où elle a passée en Angleterre, qui ne possédait pas même de sanglier dans ses forêts.' It is needless to refer to the innumerable discoveries of *Sus*, both wild and tame, in pre-Roman deposits in this country; and the unanimously accepted result of archaeological enquiry may be shortly summed up in the following words of M. Montellier's 'Mémoires sur les Bronzes Antiques' (Paris, 1865, p. 41), 'Le symbole sanglier était un symbole Celtique le plus ancien de tous les symboles adoptés dans les Gaules.' The evidence of literature tells even more strongly in the same direction. From Mr. Thomas Stephens's 'Literature of the Kymry' (second edition, 1876, pp. 236–270) I learn that this animal was taken by the Kymric poets as typifying the past and future fortunes of their race, and the number of odes translated in the pages referred to in which the persons addressed by those bards are apostrophised in its character is very great. Neither Mr. Stephens nor Mr. Davies can, I apprehend, be accused of want of sympathy with the race which they write of; but I note as regards this particular point that the only difference between them is that (pp. 237 and 270) whilst according to Mr. Davies in the Hoianau the pig is 'the symbol of Druidism,' it appears to Mr. Stephens that it 'allegorically represents the Kymry who inhabited the Principality.'

[2] It is not safe to assume that any appearance of a black colour in a pig of this country shows it to be modern, as if this colour could only be due to some cross with the breed known as 'Neapolitan,' and called conveniently by Nathusius, on account of its distribution over the Mediterranean area occupied by Rome in her best days, the 'Roman' pig. For the colour of the pig is not only exceedingly variable *per se*, as stated above, and for reasons which we do not know; but it changes, as regards entire

exceedingly variable points. The condition of neglect and comparative freedom in which the still surviving Scotch breed is described as living has no doubt been constant since the earliest times; and we may, after making some allowances, fairly suppose that it must have produced the same changes in the soft and perishable parts, and so in the entire appearance of the swine of those days, that we can see it has done in those subjected to it now. The bones of the domesticated prehistoric pig, it is almost needless to say, are the bones of small animals; nor does the early age at which the great majority of domestic swine were then as now slaughtered entirely explain this fact away.

As regards the sheep, *Ovis aries*, I have to say, firstly, that I think the caution with which any identification of any ovine or caprine bone from a prehistoric 'find' is usually recorded, should be so worded, or at least received, as to make us think it is at least as likely to be a sheep's bone as a goat's. The reverse is ordinarily taken as being implied. But anybody who will study the coloured drawing given by Low ('Hist. Nat. An. Dom. de l'Europe,' pls. i, ii, French ed.) as referred to

breeds, under the selective action of certain foods, viz. the paint-root, *Lachnanthes tinctoria*, and buckwheat, *Polygonum fagopyrum* (see Wyman, Spinola, and Heusinger, citt. Darwin, 'Origin of Species,' sixth edition, p. 9; 'Domestication,' second edition, ii. p. 332). The 'Roman' pig is now, as figured in Low, l. c., of a deep black colour almost universally; but in classical times it was not so any more than the domestic Greek pig was of which Aristotle tells us (H. A. ii. 2. 14) the wild boar differed from it in being black. It is true that the sow of Æneid iii. 392 and viii. 45, 'Alba solo recubans, albi circum ubera nati,' is spoken of (viii. 81) as 'subitum atque oculis mirabile monstrum;' but Servius *in loco*, who from his date, A.D. 400, must have been familiar enough with 'Roman' pigs, explains the word 'monstrum' thus, 'quia et subito et cum triginta porcellis est visa,' which is quite an adequate explanation. Columella also contrasts (vi. 9) a 'grex nigrae setae quam durissimae densaeque' with a 'glabrum pecus vel etiam pistrinale album' as being better suited for a 'regio frigida et pruinosa.' Hence, though there is no doubt that one of the earliest effects of domestication upon the wild-boar stock not uncommonly is to make the colour white or at least what Youatt calls 'dirty white' or 'yellowish brown,' there is also no doubt that the reverse of this may be effected by the same process in later stages or through the introduction of new disturbing influences. I incline to think that, though the reverse must have been the case with several of our common domestic animals, immigrating races of men have usually provided themselves with tame pigs by having recourse to the young of the wild-boar stock available on the area which they have occupied. For whilst wild swine everywhere lend themselves readily to domestication, it must in early times have been very difficult to transport or import even already domesticated pigs. The contrast in this latter point between the pig and the two animals, which most certainly of all must have been imported into Europe as domesticated, did not escape the notice of the ancient fabulist who, as referred to by Bochart, 'Hierozoicon,' ii. 57, p. 698, spoke of the 'porcus, qui cum agno et capra ad urbem deferebatur et quum illi pacate degerent solus se distorquebat.'

by Rütimeyer ('Fauna der Pfahlbauten,' p. 129) of the 'dun-faced,' 'flounder-tailed,' '*brevicauda*,' 'goat-horned' variety of the sheep still existing in the islands north of the Pentland Firth, will see how difficult it must be to decide the question as to the absence or presence of the sheep at any particular prehistoric period, unless an entire skull be available for deciding the question. Nor is the variation which gives to the horns of the sheep, usually considered the most distinctive portion in the prehistoric skeletons left us, the shape of those of the goat, by any means confined to the Orkney or Shetland sheep. The same approach to the goat's character is noted of the horns of the Welsh higher mountain breed (Low, Fr. ed. p. 20, Eng. ed. p. 65) of sheep. Hence it is entirely unsafe to decide from the often fragmentary and detached horn-cores which we obtain from neolithic burials that the animal they belonged to was not a sheep.

But, secondly, though a sheep may have the horn-cores usually found in goats, a goat never has the horn-cores usually found in sheep. But such may be found in prehistoric interments[1].

[1] Since writing as above I have, through the kindness of Herren Edmund von Fellenberg and Grossrath Bürki in Bern, of Professor F. A. Forel of Lausanne, and of Dr. Uhlmann at Münchenbuchsee, had opportunities for examining the very rich collections of animal bones from the various lake-dwellings which owe so much to their protecting care. And I found that the caution which is necessary in dealing with the scanty and often imperfect remains available to me from our prehistoric graves is superfluous in face of their abundant and more complete specimens. The goat is richly and unambiguously represented in the stone-age lake-dwellings, and more abundantly indeed than the sheep in the early stone-age lake-dwellings of Moosseedorf. It seems however to have lost this numerical preponderance towards the end of the stone period, and to have become comparatively scarce in the bronze age. And I find that M. Kinberg, 'Stockholm Internat. Congrès Anth.,' p. 831, tells us of Sweden that 'La Chèvre *Capra hircus* h. paraît avoir été primitivement plus rare que le mouton. Elle est rare du moins dans les sépultures de l'âge de la pierre de la Vestergötlande.' These facts are entirely in keeping with the suspicions hinted at in the text, and with the view that our domestic animals, though coming in the ultimate resort from the East, like nephrite and jade in the stone-, and bronze probably in the bronze-period, did not reach the regions north of the Alps directly from the East, but only by passing northwards from the Greek and Italian peninsulas. For the goat, as has been repeatedly observed from the time of Aristotle ('Hist. An.' ix. 4) down to the present, bears cold less well than the sheep, whilst every traveller in sunburnt barren countries may observe with gratitude and wonder what copious supplies of milk are obtained from it, often off but limited areas in these surroundings, and from but shrubs and weeds. The sheep on the other hand, is, as its resting-places on the 'Schatten-seite' of a mountain show us, more sensitive to heat and more appreciative of the 'shadow of a great rock in a weary land' than most animals. As described in the beautiful translations of a modern Greek ballad, by Niebuhr and Miss Winkworth ('Life and Letters,' vol. ii. p. 23, ed. 1852), it loves the 'still cold fountain' of the 'many fountained' mountain-top, *πολυπίδακος ἀκρωρείης*,

As regards the ox, *Bos taurus*, I have little to add to what has been written by others with the much larger stores available to their hands which the Swiss pile-dwellings and other habitations of the living prehistoric man have furnished. Rütimeyer, 'Fauna der Pfahlbauten,' p. 127, and Naumann in his interesting memoir, 'Archiv für Anthropologie,' viii. 1, 1875, p. 30, suggest that the variety of ox known in this country as *Bos longifrons*, and known abroad more correctly as regards structure, if not more conveniently as regards the appropriation of the name, as *Bos brachyceros*, is probably the oldest domestic animal with which we are acquainted. The older zoologists held (see Buffon, 'Hist. Nat.' xi. 312, ed. 1755), perhaps rather as an article of faith than as the result of enquiry, that 'on a soumis le brebis et le chèvre avant d'avoir dompté le cheval, le bœuf ou le chameau.' The dog and the pig have on the grounds of their present and their pristine distribution in space, of their readiness to attach themselves to man and share his fortunes, and, I incline to think, most of all, of their solidarity with him in supporting the alternation of generations of certain entozoa, perhaps equal claims in this matter with the other five animals specified. For my own part I should incline to favour the claims of the dog, on the general grounds of the hunting stage having been earlier in date than the pastoral and of the facility with which commensalism would be set up between the two species when they happened to enter into partnership in the chase. What I saw at Cissbury (see 'Jour. Anth. Inst.,' July, 1876, vol. vi. Article xix.) impressed me very much with the idea that the pitfall counted for much more in the earliest times than I had previously imagined.

whilst, as a visit to the hungry and thirsty, stony and light-soiled, island of Rhenea showed me, the goat will retain its vigour and independence of bearing with but the scantiest supply of succulent vegetation and of pure water. The goat possesses certain advantages over the sheep as a domestic animal in a 'barren and dry land where no water is,' but in a palustrine or lacustrine district it possesses none. And I submit therefore that the abundance of it in the Swiss lake-dwellings can be reasonably explained by supposing that it was carried thither by a people or tribe migrating northwards from the Mediterranean countries. Uncultivated races, as is well known and can still be observed, will adhere with a persistence which, if not wholly intelligent, is yet not wholly unpleasing, to their own domesticated animals even when their inferiority to other available breeds is demonstrated; and the goat, on its side, will, as Buffon has remarked ('Hist. Nat.' v. 66, ed. 1755), attach itself to man with an irrepressible fixity correlated with its traditional petulance.

The importance of these points in the natural history of the goat is impressed upon us from the purely anatomical point of view by the absence of any well-marked Western varieties of it; whilst the greater utility of the sheep in our latitudes is shown contrariwise by the multitude of such varieties into which it has effloresced under domestication in a period throughout which the goat has remained as unchanged as the weeds it feeds upon.

A wild animal was much more easily mastered in that way[1] than in any other available to the man to whom

> 'Arma antiqua manus, ungues, dentesque fuerunt
> Et lapides et item sylvarum fragmina rami.'—Lucret. v. 1282.

The wild dogs which fed themselves or were allowed to feed upon the remnants of the animals thus caught and slaughtered would not be slow to learn the lesson of attachment to place, and out of, or upon this, might very readily grow the feeling of attachment to person. It requires a greater effort of imagination on our part to imagine a pack of wild dogs co-operating with priscan men in driving a herd of wild cattle or wild pigs (both of which were represented in the Cissbury pits) along a track in which a pitfall had been dug and covered over. Still what we know of the relations subsisting between savage men and dogs or dingoes (see Nind, l. c., p. 29) justifies us in holding that this second stage of co-operation may have been attained to very early in the history of our species.

The contrast, common in ancient writings, both sacred and profane, between *Bos primigenius*, 'magnitudine paullo infra elephantos,' as Caesar wrote of them ('De Bell. Gall.,' vi. 28), and the tamed variety or varieties of the species, with the 'tenue et miserabile collum' which Juvenal (Sat. x. 270) half pathetically describes, were seen in eminently instructive shape in the Cissbury pits, the filling up of which with chalk rubble had very effectually preserved the bones. By the spar-like hardness and lustre, by the sharply-defined ridges and sculpturing of the

[1] Caesar's words (B. G. vi. 28) used of the Germans capturing *Bos primigenius*, 'hos studiose foveis captos interficiunt,' I had commented upon ('Journ. Anth. Inst.,' l. c.) before learning that Keller ('Lake Dwellings,' pp. 298, 299, trans. Lee) had written as he has done. The Old Testament writers make innumerable references to the use of the pitfall. The tradition of its employment by the Ancient Britons survived into the days of Henry V., and of Hardyng who in his 'Chronicle in Metre fro the first Begynning of Englande,' cit. Youatt on the sheep, speaks of 'pitfalles and trappes' as well as

> 'Arrows and boltes
> To slee the deere, the bull, also the bore,
> The bear, and byrdes that were therein before.'

For the use of the pitfall by the Esquimaux, see an excellent paper by N. L. Austen, Esq., in the 'Reliquiae Aquitanicae,' p. 217. The fact that the Esquimaux have fitted their pitfall for the reindeer with a trap-door revolving on two short axles of wood, as is done in the so-called 'tipe' or 'tip' in rabbit warrens, together with other considerations, makes me doubt whether Daniel ('Rural Sports,' vol. i. p. 351) can be right in holding that this last is 'a modern invention.' The Norway reindeer is similarly taken in a 'rengraven' (see Austen, l. c.), and the kangaroo in Western Australia (see Eyre, 'Central Australia,' ii. 278; Nind, 'Journ. Royal Geog. Soc.' i. p. 30, 1831).

surface, and, finally, by the huge size of the wild animals' bones when viewed in contrast with those of the tame races, we are helped as effectually as by almost any other means to realise the immense difference which exists between those times and ours; in which last the representatives of the wild ox, still surviving under Lord Tankerville's care at Chillingham in an at least half-wild state, are so much smaller, and the domestic races so much larger. The wild animal of prehistoric times to attain and sustain its vast bulk must have had command of good pasturage which even the cherished and protected herds of modern wild cattle might envy; but with this, itself a thing possible only in a district occupied but sparsely by man, there co-operated another agency distinctive of a wild country. This was the selecting agency of carnivora, in the Britain of those times chiefly wolves, which would weed out the weaker members of each herd, long before they attained the sexual maturity which might have enabled them to bring into being a stock of weakness and smallness like their own. The rifle-bullet, on the other hand, of modern days selects the monarch of the herd, and leaves the sustentation of the race to the despised smaller representatives of it. The differences between the conditions affecting the domestic breeds of ancient and modern times respectively are at least as striking. The range available to a savage tribe ever at war with its neighbours, as is the habit of modern, as it was of ancient uncivilised tribes, must have been limited and small relatively to the number of the cattle which a tribe devoid of cerealia must have had for their sustentation. This would affect the animal during the whole period of its growth, and very materially. And we have to add to this the consideration that not only were such articles as turnips wholly unknown to the ancient Briton, but that even such an art as that of making and storing hay was as yet uninvented. The contemplation of a herd of dark-coloured mountain cattle in the north of this country, of small size and yet with ragged, 'ill-filled' out contours, standing on a wintry day in a landscape filled with birch, oak, alder, heath, and bracken, has often struck me as giving a picture which I might take as being very probably not wholly unlike that which the eyes of the ancient British herdsmen were familiar with. But the treatment which the domestic ruminant is all but necessarily and universally subjected to in the very earliest days of its life when owned by a savage, is found in modern days and in very different climates from ours to be sufficient to stunt its growth effectually, even in the absence of the unfavourable conditions alluded to. The milk which naturally should have gone to build up the body of the newly-born animal is, in great part at least, taken for the use of its owner and his human family. The

vast difference in size between the domestic buffalo of Hindostan, *Bos bubalus*, and the wild variety or Arnee[1], is due, I apprehend, to the working of this agency upon the former as against the selective agency of the carnivora upon the latter; and the like causes must have produced the like effects in former times.

I take this opportunity of putting on record the points in which the collections of various objects from the Swiss lake-dwellings seen by me under the favourable conditions above specified (p. 342, note) differ from those procured from British prehistoric graves.

The absence of any traces of cerealia in our neolithic barrows puts them at once into sharp contrast with the Swiss lake-dwellings even of the early stone age such as Moosseedorf and Wangen; and though the frequent occurrence of unthrashed-out ears in the specimens from these habitations shows, as Dr. H. Christ (l. c.) has observed, that their tenants were in a very primitive state, still the presence and botanical characters of these 'Kulturplanzen,' as also of the weeds accompanying them, prove that these men had at one time or other some direct or indirect communication with Mediterranean regions. (See Prof. Heer in Keller's 'Lake Dwellings,' trans. Lee, p. 342 seqq.) The textile flax-fabrics so prominent in every series from the Swiss lake-dwellings, even from the very early one of Schaffis, are as completely wanting in British stone-age barrows as the cerealia.

A second point of equally striking contrast is furnished to us by the great inferiority of all British pottery of the stone- and bone-periods to that at least of the later stone age in Switzerland. It is true that from such a very early lake-dwelling as that of Schaffis, pottery of the most primitive kind possible, imperfectly burnt, coarse alike in composition and contour, may, as the series in the University Museum obtained through the kindness of Herr E. von Fellenberg and the exertions of the

[1] An anonymous but excellent naturalist in the 'Zoologist' (1858–1859, vol. xvi. p. 6554) writes thus as to the great difference in size existing between the wild and tame buffalo to the advantage of the former: 'We believe the main reason of it to be that the tame calves are deprived of their due supply of milk. The importance of an ample supply of suitable nourishment in early life, as bearing on the future development of any animal, cannot be over-estimated.' He also states on the authority of a friend that the Burmese domestic buffalo is 'much larger than in Bengal, with splendid horns, and altogether a vastly superior animal, in fact, resembling the wild buffalo. The Burmese never milk them; having the same strange prejudice to milk which the Chinese have, though otherwise both peoples are nearly omnivorous.' See Specimens 1350 and 1351, Oxford University Museum, the one from a wild, the other from a tame buffalo.

Rev. H. B. George shows, be obtained; and that speaking generally all the pottery of the Swiss stone age is inferior in shape, paste, and size to that of the bronze age. Still with my recollection of the best specimens of British long-barrow pottery, such as those referred to (Article xviii.) as found by myself and others, I needed when at Morges a very definite assurance from that entirely indisputable authority Professor F. A. Forel, to make me believe, as I do, that certain pottery of a much higher degree of excellence had really belonged to the stone age.

Thirdly, even in the very early lake-dwelling of Schaffis, barbed and tanged arrow-heads have been found, as indeed also in Danish and Breton stone-age interments; whilst our long barrows have, as Dr. Thurnam remarked, never furnished us with any arrow-heads perfected beyond the leaf-shape.

Fourthly, the practice of boring, however roughly and by whatever process, the stone axe for the reception of the haft was not unknown even to the lake-dwellers of Schaffis (see Herr E. v. Fellenberg's 'Bericht über die Pfahlbauten des Bielersees,' 1875, p. 78), whilst, as Mr. John Evans ('Ancient Stone Implements of Great Britain,' p. 49) has remarked, the stone axes of this period, at least in Britain, were rarely perforated.

The similarly all but, if not entirely, complete absence of nephrit- and jadeit-implements from our British prehistoric series constitutes a fifth point of contrast between them and those procured from the Swiss lakes; and to the 'Ethnographisch-archäologische Bedeutung' (to use the words of Prof. H. Fischer in his model monograph 'Nephrit und Jadeit,' 1875, p. 1; see also pp. 48, 49, 54, 355, 367, 377) of this negative fact, we must under all the circumstances of the case assign a very high place.

Wild animals, sixthly, are but sparingly represented in early British graves, whilst in some at least of the earliest Swiss lake-dwellings they have a numerical preponderance over the domesticated breeds. It is right however to add that in the early British dwellings for the living and in early British excavations such as the flint mines at Cissbury, this numerical inferiority of the wild fauna is by no means so distinctly pronounced (see 'Jour. Anthrop. Inst.,' vol. vi. 1876, Article xix.).

Seventhly, as regards the craniography of our own species, the skulls of the Swiss lake-dwellers of both stone- and bronze-periods alike belong to that 'massive and grandiose' variety of the dolichocephalic type which the Swiss ethnographers, His and Rütimeyer, have in their often-referred to 'Crania Helvetica' called the 'Sion Typus.' In other words, we have in Switzerland no such evidence for the immigration of a fresh

race of men at the commencement of the bronze period as we have furnished to us in Great Britain by the appearance contemporaneously with metal implements of brachycephalic crania in preponderating numbers. It may however be objected here that this seventh point of difference, like indeed all the other six, depends simply on negative evidence; and that the entire number of human skulls recovered from the lake-dwellings has been, as might from the very nature of the case have been expected, very small. On the other hand, I have to say that an English ethnologist, convinced, as due examination of the evidence (see p. 314 supra) will convince him, that a very thorough, if not absolutely exhaustive, displacement of the races previously in occupation of what is now his country was effected by the Teutonic immigration of the fifth and succeeding century, may very easily be over-ready to believe that other invasions may have been similarly overwhelming. The Swiss ethnologists, at all events, after fairly stating the two opposed views, declare themselves to be of opinion that one and the same dolichocephalic stock persisted through the two periods in question. Their words run thus ('Crania Helvetica,' p. 37):—'Wir sind durch diese Unterbringung des Meilen- und des Auvernier-Schädel zu einem höchst erfreulichen Resultate gelangt einsichtlich der Bevölkerung die die Pfahlbauten, während der ersten Zeit ihres Bestehens in der sog. Stein- und Bronze-Periode, bewohnt hat. Bekanntlich haben unsere hervorragenderen Alterthumforscher über dieser Punkt sich noch nicht geeinigt; eines theils vertritt Herr Troyon in seinen *Habitations lacustres* die Ansicht, es habe in den verschiedenen Perioden der Pfahlbau-Zeit eine Succession von verschiedenen Bevölkerungen stattgefunden; es sei die Bevölkerung der Steinzeit durch eine völlig neue der Bronzezeit, und diese durch eine solche der Eisenzeit verdrängt worden: anderntheils aber hat Herr Dr. Ferd. Keller aus dem allmähligen Fortschreiten der Kultur in der Pfahlbaustationen, aus der mannigfachen Formübereinstimmung der Stein- und der Bronze-, dieser und der Eisenobjecte, und aus dem Vorhandensein mannigfacher Uebergangstationen wahrscheinlich gemacht, dass die Pfahlbau-Bevölkerung der verschiedenen Kulturperioden doch nur einen und demselben Stamm, dem Keltischen angehört habe. Die Ergebnisse der craniologischen Forschung sprechen, wie man sieht, für diese letztere Annahme, und wir dürfen, gestutzt auf die ober mitgetheilte Schädelvergleichen, allerdings mit Bestimmtheit aussprechen, dass die Pfahlbaubevölkerung der Stein- und Bronzezeit desselben Stammes gewesen sei, wie die später dies Land behauptenden Helvetier.'

Some Swiss historians (see 'Crania Helvetica,' p. 34) are inclined to hold that remnants of the Cimbric invaders still survive in their

country; and the light hair combined with typically brachycephalic skull which so constantly meets the eye in Switzerland may incline us to favour this view. It may seem to be going out of the way to take up with this hypothesis when there is a characteristically brachycephalic stock occupying at the present day, as it has done no doubt uninterruptedly from prehistoric times, the conterminous region of the Grisons. The Roumansch race, however, is dark-haired, whilst the Swiss brachycephali are, especially as compared with the French, light-haired; the relations between the Rhaeti and the Helvetii was in historic times (see 'Crania Helvetica,' p. 33) ordinarily the reverse of amicable; and what appears to me the most convincing argument of all, rye, a cereal the place of origin of which is supposed by De Candolle ('Geograph. Botan. Raisonnée,' ii. 938–940) to be in the district to the east of the Alps, and which has been the staple food of the Grisons, has, like oats and spelt, never been found in the lake-dwellings.

Eastern Switzerland is known, both from linguistic and from historical evidence, to owe a very large part of its population to the Alemannian invasion; the physical characters however of this race were different from those of the Cimbric probably, and certainly from those of the Roumansch, and of the brachycephalic stock abundant in South Germany at the present day.

From the phaenomena presented by the pottery, by the implements, by the cultivated plants and domesticated animals of prehistoric times in this and other countries, arguments have been drawn in favour of one or other of three theories, which may for the sake of brevity be spoken of as the theory of Immigration with more or less displacement of any population previously in occupation, the theory of Importation without immigration, and the theory called by its supporters the 'Autochthony' of these products. It may be well here to give references to authorities who have pronounced themselves in favour of one or other of each of these three views.

In favour of the first theory we may cite Rütimeyer, who ('Fauna der Pfahlbauten,' pp. 160–162, 1861) speaks of the introduction of bronze as being a 'Wendepunkt der möglicherweise mit dem Auftreten neuer Völkerstämme in Verbindung stand;' and suggests that the appearance of a new race of domestic dogs at the commencement of that period indicates the setting up of intercourse with or replacement by a fresh race of men. In the same sense we find Prof. E. Désor ('Le Bel Age du Bronze Lacustre,' p. 11, 1874) speaking of the weeds, such as *Centaurea cyanus* and *Silene cretica*, which accompany the cerealia of the lake-dwellings, as those of modern Switzerland, thus: 'Etrangères à notre

flore comme les céréales elles-même elles ont suivi le sort de ces dernières, et nous sont venues d'Orient, peut-être avec les premiers colons lacustres.'

Dr. Oswald Heer, however, a botanist of whose investigations Switzerland may justly be proud, in laying these facts before the world, as in Troyon's 'Habitations lacustres,' p. 443, and Keller's 'Lake Dwellings,' transl. Lee, p. 344, appears to adhere to the second of the two views above stated; as indeed Keller himself does (l. c. pp. 56 and 309) in the following words used of another product foreign to Switzerland, namely, nephrit: 'It was not brought by the settlers with them from their earlier abodes, but was acquired by barter in later times, after they had lived for centuries in the lake-dwellings of our country.' In the second of the two passages referred to Keller says distinctly: 'There is no ground for concluding that successive peoples of different races or civilisations have occupied these lake-dwellings, one of which has chased the other from its abodes in order to occupy them themselves.'

In spite of this, however, scientific opinion in Switzerland seems to me to gravitate rather in the direction of the former of these two views. And this I say, though Herr Edmund v. Fellenberg ('Bericht,' l. c. p. 15) puts both of them forward without distinctly indicating to which of the two he inclines. He points out that the two minerals nephrit and jadeit are found only in Central Asia, China, New Zealand, and South America; that only a *single* unworked block, and that one probably dropped by the importers, has been found in Europe at Schwemmsal in Saxony; and that the usually sharp and little worn-down implements and weapons made of these two highly resistant minerals are found in somewhat different proportions in different parts of Switzerland, the nephrit- preponderating in the eastern and the jadeit-weapons in the western lake-dwellings; but he sums up the discussion by asking impartially, 'Sollten Einwanderungen von verschiedenen Seiten stattgefunden haben, oder hatten diese Stämme Handelsbeziehungen nach verschiedenen Richtungen hin[1]?'

The third view, diametrically opposed to the two first enunciated, was put forward by M. Dupont, with the protection of the honoured name of Steenstrup, at the meeting of the International Anthropological Congress at Stockholm in 1874, in the following words ('Compte Rendu,' p. 821):—

[1] Mr. H. Cayley's valuable account of his own visit to the old Jade quarries of Kúenlún given in Macmillan's Magazine for October, 1871, appears to have escaped the all but exhaustive research displayed in Dr. Heinrich Fischer's 'Nephrit und Jadeit,' already referred to, p. 347.

'Dans la précédente session du Congrès, M. Steenstrup a émis l'idée, après avoir examiné les collections recueillies dans les cavernes belges, que nos principales espèces domestiques pourraient à la rigueur être originaires du sol qu'elles habitent et y avoir été directement assujeties par l'homme. Cette solution est loin d'être improbable. Elle a ceci de frappant de se trouver en accord avec les principes qui tendent à s'établir dans l'anthropologie, et d'après lesquels les conquêtes violentes et les déplacements des peuples auraient joué dans la constitution de nos populations un rôle fundamental moins important que celui qu'on avait été d'abord porté à leur attribuer; la grande masse des habitants d'un pays étant composée par les très anciens occupants du sol et non par les envahisseurs. Ces principes ont été surtout soutenus avec conviction par MM. de Quatrefages et Virchow durant ces dernières années pour les peuples Européens. La même thèse a été défendue récemment à l'aide d'une grande érudition et d'une argumentation persuasive, pour les langues occidentales[1]. Je crois, pouvoir prouver de nous côté que notre âge de la pierre[2] polie n'est pas le résultat d'une importation, mais qu'ila pris naissance dans nos regions mêmes.'

Professor Steenstrup is reported as having expressed himself entirely to the opposite effect in the 'Compte Rendu' (p. 163) of the International Congress held at Copenhagen in 1869; and unless he changed his opinion in the interval between 1869 and 1873, it must be through some error that his name is quoted as in the above extract from the Stockholm 'Compte Rendu.' There is no room however for suggesting that the reference to M. Granier de Cassagnac's work is made through inadvertence; and I must remark therefore that no conclusion however much in want of support can gain much by a reference to that production. On the other hand, the respectable authority of Dr. H. Christ (in Rütimeyer's 'Fauna der Pfahlbauten,' pp. 225–226) can be brought forward for 'die Autochthonie' theory.

I cannot understand how any one with the evidence properly before him can doubt that the goat, sheep, horse, and dog were in the earliest neolithic times imported as domesticated animals into this country and into Switzerland. The ease with which the calf of a pit-fall-taken *Bos primigenius* would be domesticated, as well as some other reasons, may make it just possible that the domestic cow of those times may not in all cases have been imported already tamed. But I incline to think that this really was most commonly the case.

On the other hand, having been convinced by what I saw in the Swiss

[1] Granier de Cassagnac, 'Les origines de la langue Française.' Paris, 1872.

[2] 'Compte rendu du Congrès de 1872,' p. 459.

collections from Schaffis and elsewhere that the small race of swine *Sus scrofa*, var. *palustris*, existed there as a wild race; and coupling this with the facts, on the one side, of the exceeding readiness with which this species lends itself to domestication, and on the other side, of the considerable difficulties which attend its transport over great distances in space, I incline to think that this animal may have had a different history from the others just mentioned, and may have been domesticated upon the spot.

XVIII.

ON THE PEOPLE OF THE LONG-BARROW PERIOD.

Introductory Remarks.—In this paper I propose to give in detail a description of the examination of three long barrows situated near the little village of Nether Swell, in the county of Gloucester, prefacing this account by some general remarks—firstly, as to the physical characteristics of the people of the long barrow period; secondly, as to the possibility of dividing that period into successive epochs; and thirdly, as to the rationale of the various modes of disposing of the dead observable in those early tumuli. In these prefatory remarks I shall not confine myself to the facts observed in the Gloucestershire explorations, but shall use, for purposes of comparison, my records of the investigation of similar barrows carried on by me in Yorkshire and elsewhere, with the valuable assistance of Canon Greenwell.

Looking at the osteological remains as a whole, perhaps the most striking point is the great disproportion in the sizes and the lengths of certain of the long bones, and, by consequence, in heights, of the male and female skeletons respectively. The male skeletons were very ordinarily about 5 feet 6 inches in height, as against a height of but 4 feet 10 inches attained to by the female. The average difference between the statures of males and females in civilised races is about half this amount, whilst a precisely similar disproportion is observable at the present day between the stature of individuals of the two sexes amongst savages[1]. The clavicles

[1] The late Sir Andrew Smith, K.C.B., informed me, that from extensive observations, carried on for a period of seventeen years, in South Africa, he could assure me that the Amakosa Kaffirs to the eastward of the colony averaged near 5 feet 8½ inches, women 5 feet ½ inch. (See 'Archaeologia,' 1870, vol. xlii. p. 457, where I put this observation, and a number of other measurements bearing upon this point, on record.)

show the disproportionate smallness of the females even more strikingly than the bones already alluded to. Professor Busk has recorded the small size and delicate form of the clavicles from the Gibraltar caves[1].

To the relative size of the skulls in the two sexes in prehistoric times, the doctrine laid down by Retzius in 1845[2], and re-affirmed in 1854 by Huschke[3], as to the upper and lower classes of modern society, and the civilised and uncivilised races of modern days, is

Gustav Fritsch, in his work, 'Die Eingeborenen Süd-Afrikas,' s. 17, gives 171·8 cm. (5 feet 7½ inches) as the average stature of men of that race of Kaffirs just mentioned, and at p. 24 he says of the females: 'Pflegen die weiblichen Individuen in der Entwickelung den männlichen nachstehen was wohl in der unterdrückten politischen Stellung der Frauen seinen Grund hat;' but he does not give their exact stature. At p. 216 this author says, 'Die Frauen der Ova-herero erscheinen in gleicher Weise wie der übrigen Süd-Afrikanischen Nigritier in Vergleich mit den Männern unbedeutend,' and at p. 277 he gives 160·4 cm. (5 feet 3 inches) for the average stature of ten male Hottentots, as against 144·2 (4 feet 8 inches) for the average attained from measuring four females of the same tribe. When, however, the stature of the male members of a race falls as low as that just given for the female Hottentot, the stature and other dimensions of the sexes appear to be nearly identical. This is the case with the Bushmen (see p. 398, l. c.). The measurements, however, given by Weisbach in the Anthropological part of the 'Reise der Novara,' 1867, p. 216, do not show that the discrepancy between the stature of the sexes of savage races rises in a direct proportion with their savagery, the greatest difference put there upon record being that between Java men, 1679 mm., and Java women, 1461·2, and amounting to 8½ inches, whilst the difference recorded between Australian men and Australian women is only 65 mm. (2½ inches). A similar disproportion, and one even greater than that recorded by Weisbach for the Javanese males and females, has been reported to me as the rule amongst the Japanese; whilst, on the other hand, a 'Report on the Aborigines of Victoria,' 1859, p. 45 (cit. Davis, 'Thesaurus Craniorum,' p. 364), gives 5 feet 6 inches as the average height of eleven Australian men, as against 4 feet 10½ inches of an Australian woman. (See, however, Davis, 'Phil. Trans.' for 1868, p. 524.) The honourable position assigned to, or obtained by, the female sex amongst the Germanic races may be considered as testified to by the near approach to equality in stature which, even in ancient times (see 'Smith's Dictionary of Geog.,' art. 'Germania'), was observed to exist between the sexes. Liharzig, however, most surely under-estimates the difference when, in part following Quetelet and Bednär, he gives, in his great work, 'Das Gesetz des Wachsthumes,' p. 4, Taf. i, ii, iii, iv, 175 cent. (68·899 inches) as the average male stature, and 173 cent. (67·111 inches) as the average female stature. The rationale of all this lies in the earlier attainment of puberty by the female sex in our species, and the consequent early consignment of the females, in savage varieties of it, to child-bearing and hard labour. Mr. Dobson's paper on the 'Andamans and Andamanese,' published in the preceding number of the Journal of the Anthropological Institute, p. 457, furnishes a good illustration of this principle. (See especially Plate xxxi.)

[1] 'Trans. Internat. Congress Prehist. Archaeology,' 1869, p. 158.

[2] 'Müller's Arch.,' 1845, p. 89.

[3] 'Schädel, Hirn und Seele,' p. 48.

ordinarily supposed to apply, *mutatis mutandis*. Broca, in his interesting paper on the 'Caverne de l'Homme Mort,' says[1]: 'L'un des traits les plus remarquables de la série de l'Homme Mort, c'est la grande capacité relative du crâne des femmes.' The head of the female occupants of this cavern, like the head of the rustic Dalecarlian females, as observed upon by Retzius, was but little—some 99·50 cub. cent. (6 cubic inches)—inferior in capacity to that of their male fellow Troglodytes, whilst the difference between the modern Frenchman of Paris and the modern Frenchwoman is more than twice as great as this amount. Where a woman is told by symbols, no less than by precepts, as Tacitus tells us[2] the German women were told, 'venire se laborum periculorumque sociam, idem in pace idem in praelio passuram ausuramque,' it is easy to understand, upon the principle of natural selection, how an equality, or, at least, a near approach to equality, in the physical, as well as in the moral and mental character of the sexes, may come to prevail, and how the weight and stature of the entire body in the female sex may approximate to the proportion of the male sex. Such, however, is rarely the case in savage tribes and times, and what we usually find, both among modern savages, as testified to by Weisbach[3], and among prehistoric men, as I have found, is an exaggeration in the females of the disproportion which exists, even in civilised races, between their brain and their entire body weight, to the disfavour of the latter, which is relatively heavier in the other sex.

Without going into the familiar statistics which tell us that the brain attains very nearly its full weight at a very early age, I will just add that the average circumference of the head is shown by Liharzig[4] to be but about an inch less in either sex at the age of fourteen than it is in adult life, the measurements being 54 as against 57 centimetres for the male, and 52·5 as against 55·5 for the female sex. Now, when the differences in treatment and mode of life, which have already been alluded to as accounting for the dispro-

[1] 'Revue d'Anthropologie,' ii. 1, p. 45, 1873; and 'Bull. Soc. Anth.,' Paris, tom. viii. ser. ii. p. 832, 1874.

[2] 'Germania,' 18.

[3] 'Reise der Novara,' 1867, 'Anthrop. Theil,' s. 222.

[4] 'Das Gesetz des Wachsthumes,' Taf. vi.; which table shows also that the female head is, at 21 months, 48½ centimetres in circumference as against 50 for the male.

portion in the size of the entire body observable among certain savages of either sex, do exist, they do not come into play ordinarily till after the age of fourteen, when the skull and its contents are incomparably nearer to their full size than the weight and size of the body are to their adult measurements; and it is obvious, therefore, that neither in civilised nor in savage life is there any *à priori* improbability that the brain and skulls of the two sexes should be at least sub-equal, however widely their entire body-weights may differ.

The female skulls labelled 'Swell i. a,' and 'Swell vi. 2, 2,' show, by their measurements given below, that some, at least, of the women of the Neolithic period, in Gloucestershire, stood in the same favourable relation of cranial capacity, as to the men of that time, as that which Broca has recorded on behalf of the women of the Caverne de l'Homme Mort, whilst the other bones from these barrows speak to the existence of opposite relations between the trunks and limbs of the two sexes. On the other hand, another female skull, 'Swell i. 1, 22-9-1874,' presents an inferiority of size as compared with the male skulls and the other female skull found in the same barrow and in its immediate vicinity, which may be expressed more clearly than by its detailed measurements, by saying that, previously to the restoration of the larger female skull, 'Swell i. a,' this smaller one could be got into its interior. This shows that as great differences might exist in savage races between the skulls of the sexes as Huschke and Broca have noted as being usual in civilised times. These latter differences we may be allowed to ascribe to differences in education; the former may, perhaps, be explained by the relatively smaller-sized crania of female savages having belonged to women who, during their early childhood, and whilst their brains were being built up, had been subject to the disadvantages of scanty diet. 'Savages,' Mr. Bagehot has told us, 'are the poorest of the poor;' and in a stone age, devoid of cerealia, scarcity of game, or a murrain among domestic animals, would bring famine alike upon the families of the chief, with whom, I take it, we have here mainly to deal, and upon their serfs. The same privations, the subjection to which at and after the time of puberty, say fourteen years of age, we have suggested as the cause of the disproportionately short stature of the women, would, if they came into play upon the same subjects when at the age of fourteen

months, or earlier, be competent to stunt the growth of their brains in like ratio. It is, indeed, as the late Professor Phillips once remarked, something to be wondered at, considering the hardships and scanty dietary to which all, or nearly all, wild races of men are more or less subjected, that their skulls and brains should be as large as we find them to be. 'Ill-filled' skulls, consequently, to use the expressive epithet employed by Professor Cleland[1], are not very rare in series taken from long barrows.

By an 'ill-filled' skull, Professor Cleland tells us, he means a skull the exterior surface of which is marked by 'a mesial and two lateral ridges on the roof, with flatness of the adjacent surfaces,' and which has 'its position of greatest breadth high up upon the parietal bones.' The mesial carina may, I would add, be prolonged in such skulls over the frontal bone, and the frontal tubera may retain their infant-like prominence. To these peculiarities I would further add the presence of two depressions on the exterior of the skull, corresponding to convexities on its interior surface, as completing in many ancient and modern savage crania the character of 'ill-filledness.' One of these depressions is well known as the 'post-coronal furrow,' but inasmuch as the mesial vertical carina often developed in male skulls may be, and often is, continued along the line of the sagittal suture, so as to divide the so-called 'furrow' into two parts, this name is not a happy one. The second of these depressions corresponds to a part of the parietal bone which lies a little above its posterior inferior angle, and immediately, therefore, above the part of the bone which is furrowed internally for the lateral sinuses. As in the former case, an inward ingrowth corresponds to the outwardly visible concavity, so that much such an appearance is produced as we can imagine would have resulted from pinching in the skull walls over this area, had they been plastic. I have been able to demonstrate the rationale of these depressions in the following manner:—By removing from a skull, with its brain *in situ*, the greater part of its roof, but leaving of this structure one antero-posteriorly-running arch of bone, corresponding to the sagittal, and two transversely-running half-arches, corresponding respectively to the half of the coronal and the half of the lambdoid sutures on one side, the exact position of all the main convolutions and fissures of the brain can be shown in their normal relations to these land-

[1] 'Phil. Trans.,' 1870, vol. 160, p. 148.

marks in the vault of the skull. It will make the matter plainer, and at the same time facilitate the production of similar preparations in other museums, to say that a brain, under such surroundings, presents something of the appearance in the skull which a living head does when subjected to measurement in such a cephalometer as that of M. Antelme[1]. By means of such a preparation it is easy to show that the post-coronal depression in the roof of the skull does not correspond, as supposed by the late Dr. Thurnam[2], to the fissure of Rolando, but to the deep, and often wide, fissure which divides the superior frontal convolution into two well-defined lobes, and abuts upon the ascending frontal convolution, by a terminal bifurcation into two arms of considerable length. This fissure, as is well known, exists, and has often been described and figured in the brains of the anthropomorphous apes, in the crania of which animals the post-coronal depression is sometimes indicated when the sagittal carina is absent. Similarly, the second of the depressions which I have noted as commonly present in the postero-inferior part of the parietals of 'ill-filled' skulls, may be seen to correspond to a certain multiradiate fissure frequently noticeable on the posterior or convex aspect of the middle temporo-sphenoidal convolution, but, as far as I know, not named by any of the numerous writers who have followed Gratiolet in describing the convolutions and fissures of the cerebrum.

Professor Bischoff, however, in his well-known paper on 'Die Grosshirnwindungen des Menschen[3],' speaks of certain fissures, without any well-defined character, which appear on the boundary between the parietal and occipital lobes, and says that they correspond to a 'fissura occipitalis externa' which appears in the human foetus, but is normally limited in duration to the seventh and eighth months of intra-uterine life. Though brachycephalic skulls have not, as yet, been proved to have been found in Great Britain in any primary interments in the barrows of which I am writing, and though brachycephalic skulls from the United Kingdom, and, indeed, I am inclined to think, from European countries

[1] See 'Mém. Soc. Anthrop. de Paris,' tom. i. pl. vi. fig. 2.

[2] 'Nat. Hist. Review,' April 1, 1865, p. 267.

[3] In the 'Abhandlungen der k. Bayer. Akademie der Wiss.' Class ii. Band x. Abtheil. ii., 1868, pp. 448, 450, 495; or 'Separat-Abdruck,' pp. 58, 60, 105, and Taf. x. fig. 7.

generally, are ordinarily well- and not 'ill-filled' skulls, it may, nevertheless, be allowable to say here that the 'brachycephali angustiores,' as Professor Cleland would call [1] the brachycephali of several other parts of the world, frequently present the depressions of which I have been writing. An excellent instance of the postero-parietal inward pinching of the skull-walls was furnished to me quite recently by a Maori skull presented to the University Museum by Dr. Batt, the skull having a latitudinal index of 79, and possessing also markedly the contour which induced Retzius to class the Maoris as 'brachycephali.'

When we come, however, to compare the long-barrow people with the still surviving inhabitants of the Southern Sea Islands, a comparison first instituted by Dr. Thurnam [2], we must guard ourselves from supposing that 'ill-filled' skulls are by any means the rule amongst the ancient British inhabitants of this country, as they are amongst the little favoured indigenes of Australia and Tasmania. Dr. Thurnam's own tables of the capacity of the skulls and the weight of the brains of the modern English and the ancient Briton [3], which show that the larger quantities characterise the older race, furnish the needful qualification to his above-cited comparison. To this I would add, that in none of the long-barrow skulls which I have had the opportunity of measuring has the altitudinal index been found to be lower than the latitudinal; and that a point of degradation, therefore, has been found wanting in this series which Professor Busk has observed to exist in some priscan dolichocephalic skulls, and in Tasmanian and Bushman crania amongst those of modern savages [4]. The same facts may be expressed in another way by saying that the 'Sion Typus [5]' of His and Rütimeyer, a type which Rütimeyer [6] has spoken of as characterised by 'Kräftigkeit und Würde,' is by no means sparsely represented in the long-barrow series, the larger female skulls corresponding very closely with the description given by those

[1] See 'Phil. Trans.,' 1870, p. 148.

[2] 'Mem. Soc. Anth., Lond.' iii. p. 24.

[3] L. c., vol. i. pp. 55 and 57.

[4] See 'Journal Ethn. Soc. London,' Jan., 1871, p. 467.

[5] For a description of the several types of prehistoric crania, as given by His and Rütimeyer, see their 'Crania Helvetica,' 1864; or Huxley on 'Prehistoric Remains of Caithness,' p. 103 seqq., 1866.

[6] 'Jahrbuch der Schweizer. Alpen' for 1864, p. 398.

anthropologists of that type, whilst many of the male skulls, in which the smoothly-swelling globose outlines and rounded-off contours of the female skulls are replaced by muscular ridges, vertical carinæ, and foreheads sloping in correlation with heavy lower jaws, might be taken as fair, if not precisely accurate, representatives of the Hohberg type which is so closely allied to it.

A few pathological and teratological peculiarities will be noticed in the detailed account to be given below. It is interesting to note, that in no case have the wisdom teeth been observed to have come through previously to the ossification of the spheno-occipital synchondrosis. This is the reverse of what has been observed in certain savage races, ancient and modern, by M. Broca[1]. Perhaps the pastoral habits of these tribes may account for their conformity in this particular to what is usual in civilised races, a diet of milk, cheese, and flesh causing less injury to the teeth, and being less likely to call the wisdom teeth prematurely into use than one in which vegetable food forms a large factor. The bones of animals found in these barrows were, it may be noted, and again contrary to expectation, those of domestic breeds almost, or quite invariably[2].

As regards the age of the long barrows, there is no doubt that, whatever other traces of the presence of man may be found in these islands, they are the earliest sepulchral evidence of his existence here. The huge cubical bulk of some of these tumuli is an *à priori* argument for their antiquity. Pristine or priscan man, like the modern savage, grudged no labour less than that which was spent on piling up a huge burial mound. My friend Mr. H. N. Moseley, naturalist on H.M.S. 'Challenger,' in recording his observations on the Kudang tribe of Australians living near Cape York, tells me that though they are destitute of almost everything in the way of property, having neither perforated stones to help them to dig roots—as have the Bushmen—nor boomerangs, nor tomahawks, nor any shaped stone implements, nor canoes; living, not on the available wallabies and phalangers, but on fish, reptiles, invertebrata, and vegetables; having the scantiest clothing, and sometimes, even in the cases of adults, none at all; being, finally, below savagery,

[1] 'Revue d'Anthrop.,' ii. 1, p. 21, 1873.

[2] *Per contra*, in a pit within the British fort at Cissbury, *Bos primigenius* and wild-boar bones were found.

as understood by a good judge of it—Professor Nillson—in having no chiefs; they nevertheless take great pains with the burial of their dead, marking out and adorning the graves with posts, and decorating them with the bones of the dugong. It is true that the long-barrow people can be proved to have been in a higher state of civilisation than are these miserable Kudangs, by the purely quantitative considerations—firstly, that their barrows are so large as they are, and, secondly, that they contain so few skeletons.

But when a small number of individuals can get large structures erected for their lodgment, either when dead or alive, the society in which they have lived, or are living, has attained some elevation, however low, in the road leading upwards from sheer barbarism. On the other hand, the poet of a civilised age, catching, as a poet sometimes does[2], the essential features of early times with a singular, or even a scientific, accuracy, writes of a prehistoric funeral thus—

> Ergo instauramus Polydoro funus, *et ingens*
> Aggeritur tumulo tellus[3]—

whilst, at the same time, his friend Horace, and their common patron Maecenas[4], could utter their injunctions, and sympathise with the wishes expressed in the lines—

> Absint inani funere neniae,
> Luctusque turpes et querimoniae;
> Compesce clamorem, ac sepulcri
> Mitte supervacuos honores[5].

Considerations of less generality, but not, perhaps, less convincing as regards the early date of the long-barrows, are drawn from the facts, that in none of them in Great Britain has any metal implement been found, at least in connexion with a primary interment; that tanged and barbed arrow-heads are similarly wanting in these

[1] Nillson's 'Early Inhabitants of Scandinavia,' ed. Lubbock, p. 167.

[2] See, in illustration of this, Wordsworth's lines, near the end of the eleventh book of the 'Prelude;' or Tennyson's lines describing the condition of Britain in the interval between the evacuation of it by the Romans and the establishment of a new order of things ('Idylls of the King. The Coming of Arthur,' line 6, seqq.).

[3] Vergil's 'Aeneid,' iii. 62.

[4] The line, 'Nec tumulum curo, sepelit natura relictos,' ascribed to Maecenas by Seneca, Ep. 92, justifies us in thinking that Horace, in the lines quoted in the text, was not merely reproducing the epitaph of Ennius—

> 'Nemo me lacrymis decoret nec funera fletu
> Faxit. Cur? volito vivu' per ora virum.'

[5] Hor. Od. II. xx. 21–24.

tumuli, so far as Great Britain is concerned, though they have been found in such structures both in Denmark and in Brittany[1]; thirdly, that when they do contain burnt bones, those burnt bones are never found in urns; and, fourthly, that a very much larger proportion of the bones from these tumuli present the manganic oxide discolouration, so characteristic of antiquity, than has been observed in the series of bones from any other ancient burial-places.

If it is easy and safe to speak of the long barrows *en masse* as being undoubtedly the oldest sepulchral monuments with which we are acquainted, much difficulty and danger attaches to any attempt at dividing the long-barrow period into different epochs. If we know, as we do know on irrefragable evidence[2], that two modes of disposing of the dead so diametrically different as inhumation and cremation have been practised contemporaneously, and by the same people, on the same area, it is impossible, it may be thought, to lay weight on any differences in sepulchral details for proving differences of date. Again, it may be urged, and should be borne in mind, that, in a country intersected by woods and water as Great Britain was in and long after the period we are dealing with, tribes living at what we now consider but short distances from each other might be practically quite isolated, and develop thus entirely independent manners and customs. And, thirdly, though Diodorus Siculus has told us[3] that peace ordinarily prevailed between the multitudinous kings and chiefs in this island, we may set our knowledge of the condition of things, as to war and peace, prevailing among savages of the present day against this statement. I have been informed by the Rev. W. G. Lawes, who was for many years a missionary in Savage (Niue) Island, that he found that very few of the natives had ever been more than two or three miles from the place they were born in, the condition of blood-feuds which prevailed between the various septs and clans rendering it unsafe to do so. Analogous accounts are given to us by Australian travellers, which enable us to understand that very complete separation of one tribe from another may be compatible with this living in the immediate neighbourhood of, and contemporaneously with, each other. On

[1] See Thurnam, 'Ancient British Barrows,' 'Archaeologia,' vol. xlii. pp. 34 and 71, separate publication.

[2] See 'Archaeologia,' xlii. p. 434.

[3] 'Biblioth. Hist.,' v. 21.

the other hand, it is not impossible that the arrangements noted in some long barrows may indicate an approximation towards the practices characteristic of the round-barrow period, and may, consequently, be considered as denoting that these barrows belonged to a later age than others in which no such arrangements have been detected. The great and cardinal difference observable between long barrows lies in their containing burnt or buried bodies. The immense majority of the long barrows in the south of England were erected for inhumation, whilst exactly the reverse of this has been the rule in the Northern Counties.

We will begin by asking whether there is any reason for supposing that the builders of these two kinds of barrows, separated thus in space, were also separated in point of time? Some weight, though not much, may be laid upon the fact that cremation was, in Great Britain at least, the rule during the Bronze Age, as it is possible to suppose that the practice of cremation was borrowed by the people of the latter part of the Stone Age from the strangers who introduced them to the use of metal. A survey, however, of the records of the 'Steingräber' of Scandinavia, Denmark, Schleswig-Holstein, and North Germany, such as is given by Weinhold in his 'Todten-Bestattung,' 1859; or in the 24th Bericht of the Schleswig-Holstein-Lauenburg 'Gesellschaft für Alterthümer' for 1864, will not suggest that time rather than, or even in co-operation with, severance in locality, has had anything to do, necessarily, with the causation of this difference. Dr. Anderson[1], however, appears to think that, in the long cairns of Caithness, burial may have preceded cremation; and it seems likely that the short cairns, whilst affined to the round barrows by this character of shortness, were at once later in date than, and yet genealogically connected with, the long cairns. And in the short cairns cremation was the rule. Some fragments of pottery, with a thong-pattern, closely similar to, or identical with, that so familiar to us from the round barrows, were found by me in a cremation long barrow near Market Weighton, in the East Riding of Yorkshire; and the same may be said of some pottery found with leaf-shaped arrowheads, by Dr. Anderson, in a short cairn in Caithness. This may seem to give some stronger ground for supposing the cremation barrows to have been later in date than the other. Very similarly

[1] 'Proc. Soc. Ant. Scot.,' June, 1868, p. 508.

patterned pottery, however, is figured by Dr. Thurnam from a chambered long barrow at West Kennet, Wiltshire[1], and its presence there would, of course, invalidate any argument which its presence in a cremation barrow might have tempted us to draw. That presence, however, in the Wiltshire barrow is supposed by Dr. Thurnam[2] to have been due to a subsequent intrusion into, or occupation of, this chambered barrow by the metal-using Belgae. But the fact that much pottery, elegantly marked and delicately made, albeit not lathe-turned, has been found in Continental barrows of the Stone Period[3], may make us think Dr. Thurnam's suspicion somewhat unreasonable; and, if we do think it so, the argument from the presence of such pottery in the cremation long barrow in the East Riding falls to the ground[4].

If it is unsafe to suppose it to be anything more than a probability that the practice of cremation may be considered to mark a later, and the practice of inhumation an earlier, epoch in the long-barrow period, there is still less reason for suggesting that the unchambered long barrows were anything but contemporaneous with the chambered. But a question may arise as to whether those long barrows in which the receptacle for the dead took the shape of a closed 'cist,' without any passage or gallery leading to the exterior, as in the chambered barrows, may not, as being more nearly approximated in shape to the cists in the round barrows of later times, have been also nearer to them in point of date. The long barrow in which the closed cist has taken the place of the galleried chamber is by no means so common as either the chambered barrow, or the unchambered, used for inhumation, or the cremation long barrow. A very competent antiquary[5] has expressed himself to me as doubting whether *true* cists are ever found as the primary places for

[1] 'Cran. Brit.,' Pl. 50, p. 3.

[2] 'Archaeologia,' xlii. p. 72.

[3] See Weinhold, l. c.

[4] As it is but a few years since it was currently held that no pottery was to be found in the long barrows, at all events of the north of England, it may be well to say that a coarse, particoloured pottery, containing large fragments of pounded pebbles and shells, which we may suppose to have been manufactured for domestic purposes, is very abundantly represented by shards in the long barrows both of the north and south of England. Pottery of similar paste, but rolled into finger shaped masses, was found in some abundance in a long barrow (Swell i.) in Gloucestershire. Similar pieces of pottery, used in the manufacture of other *fictilia*, have been shown me by Sir Henry Dryden, Bart., from ancient structures in Brittany.

[5] So Nillson, l. c. p. 166, says, 'Every tomb had its side gallery.'

interment in such barrows. Several instances, however, have been put on record in which there seems to be much reason for accepting the description of the existence of such cists so placed. The account of the exploration of the Littleton Drew Long Barrow, successively by Sir Richard Colt Hoare and by G. P. Scrope, Esq., M.P., given in the description of Pl. 24 of the 'Crania Britannica;' and that of the exploration of the tumulus of Charlton Abbots, given by L. Winterbotham, Esq., in the 'Proceedings of the Society of Antiquaries,' April 19, 1866, appear to me to give trustworthy histories of such discoveries; and other examples may be found in Dr. Thurnam's paper on 'Long Barrows' in the 'Archaeologia' for 1869.

Weinhold[1] divides the Hünenberge into two classes, accordingly as they contain 'cists,' or chambers with galleries[2]. In a long barrow, 'Swell vi.,' I found what appeared to me to have been a closed cist, containing a considerable number of human remains, and also the skeleton of a dog, as will be related at length further on. This receptacle had been much disturbed, and I shall not, therefore, lay any weight upon the presence, a short distance above it, of some fragments of finer thong-marked pottery than I have seen from any other long barrow; still, some traces of a passage or gallery leading to it would, I think, have been discovered if they had existed. The bones from this, as also from another somewhat similarly dilapidated sepulchre in the same barrow, had less of the manganic oxide discolouration than was observable upon bones from the galleried chambers in this district; and though this may be explained as being due to some chemical difference in the soil, it is also possible that it may indicate a lesser antiquity in the bones so affected, as compared with the others.

On the whole, I am inclined to think that indications are not wanting which suggest to us that inhumation will ultimately be shown to have been the earliest mode of burial practised in these, as yet the earliest of known sepulchres; that inhumation in galleried chambers was probably the earliest variety practised, at least where the necessary slabs for the construction of such chambers and

[1] L. c., p. 6.

[2] So Engelhardt, in his 'Catalogue of the Antiquities in the Copenhagen Museum,' speaking of the 'Grabkammer of the stone age,' says it 'hat *bisweilen* einen niedrigern bedeckten Steingang' (p. 9, ed. 1872).

passages were available; but that burial without burning, and also without any cist or chamber whatever, may, in other districts not so conditioned, have been contemporaneous with burial in chambers; and finally, that inhumation in cists without passages leading down to them, and cremation, mark later epochs in the long-barrow period. The questions are in need of further evidence for their definite solution, and they are beset with numerous difficulties and sources of fallacy.

Coming, in the third place, to a consideration of the modes of burial observable in long barrows, and the rationale to be given of them, I have to say that one peculiarity appears to me to characterise all long barrows, whether they contain burnt or unburnt bodies, and that this peculiarity is, that whether the number of bodies be large or small, they occupy but a relatively small part of the entire tumulus. In other words, the bony remains, burnt or unburnt, are huddled together in short compass, whilst, so far as we see on the first contemplation of their arrangement, they might have been disposed with little or no more trouble at intervals throughout the tumulus. A segment or two of the entire length of the barrow has been employed for the reception, all the rest has been erected for the honour of the dead. In a long barrow near Market Weighton, containing some twenty-six burnt skeletons, the whole number were found within a distance of 60 feet from its east end; of these twenty-six, twenty-one were buried in a segment of 32 feet in length, and of these twenty-one, seventeen lay in a length of 17 feet. In another barrow, also of the cremation variety, near Kirkby Stephen, and 179 feet in length, the whole number of burnt bodies amounted only to seven, but they were crowded into a segment of the barrow which was but 3 feet 6 inches wide and 12 feet 6 inches in length. A chamber 7 feet by 4 feet, in one of the Gloucestershire barrows, 'Swell vii.,' contained, even after having been exposed to rifling by the rustics of the neighbourhood during a period of many years, remnants of no less than nine adult skeletons. Another receptacle which I examined in another barrow ('Swell vi.') close by, and which I believe to have been a cist, though, from its having been disturbed, it is a little unsafe to speak quite positively, contained within a space of 5 feet 6 inches by 4 feet, parts of two adult unburnt skeletons, male and female respectively, parts of three children about seven or eight years of age, and the skeleton

of a dog buried with the woman's skeleton; whilst a similar receptacle in the same barrow, examined by Canon Greenwell, contained parts of no less than ten human skeletons, all but one of which had belonged to adults, packed together within an irregularly-shaped space, which was 8 feet 6 inches long, and 4 feet broad at one end and 3 feet at the other. When these crowded masses of bones are looked at *in situ*, they strike the observer as having certain sets amongst them left in their natural relations and juxtapositions, whilst certain other bones have been somehow dislocated away from their normal connections. The upper cervical vertebrae, for example, I find myself to have noted as retaining, in many cases, their position of approximation to the lower jaw and the base of the skull; the same is recorded occasionally of a larger or smaller number of the dorsal and lumbar vertebrae, and of the patellae in their relations to the tibiae and femora, whilst portions of the pelvis, of the feet, of the humerus, and of the scapular arch, may also be found all close together. It may be well to give here an extract from the notes taken of part of the excavation carried out in a cremation long barrow near Kirkby Stephen, in Westmoreland:—

'Monday, Aug. 24, 1874.—Two strong adult men were represented, within a circle of 1 foot 6 inches diameter, by portions of their lower jaws, of their skulls, of their second cervical vertebrae, and of their scapulae. A fragment of an occipital bone was seen looking upwards, with the proximal end of a right humerus on one side of it, and the distal of a left one on the other, and portions of an atlas also in relation with it. But fragments proving the presence of two odontoid vertebrae, and shortly afterwards of two lower jaws, were found close by, as also an os calcis and an astragalus, which last were less than an inch from a clavicle, whilst, finally, a number of vertebrae were found in apposition, and parts of two scapulae were in relation with the head.'

In the case of a third skeleton, out of the seven found in this barrow, a patella, the only one found in the entire set, was found in apposition with the proximal end of a tibia. In the cases of the bones whence evidence was drawn for the presence of four other burnt skeletons in this large barrow, it seemed from their condition of arrangement, or rather disarrangement, that they must have been disarticulated before they were burnt.

The plan employed for burning bodies in the cremation long barrows examined by me, with the help of Canon Greenwell, as also in others examined by him previously and independently, was that of packing the bodies—whether fresh or dried, whether still in continuity, or disarticulated, along the central axis of the barrow—together with wood and stones. The combustible and transpirable mass thus formed reaches half, or much less than half, the entire length of the barrow. It was bounded and supported on either side by the lateral masses of the barrow, in which, in some barrows, a system of flues for favouring draught appears to have been provided by the mode adopted for arranging the large stones of which they were made up, and which, in other barrows, appear to have been made up of turfs which would serve as non-conductors by abutting upon the central combustible strip. In the barrow near Market Weighton the turfs must have been arched over the central strip, thereby greatly favouring calcination, as in a kiln, whilst externally they were supported by lines of stone rubble, which kept them in place. This short description is sufficient, perhaps, to convince the reader of what examinations, lasting many days, convinced the writer was the case—viz. that whatever was done in a cremation barrow with more or few skeletons, was done at one time, once and for all.

There have been three theories put forward to account for the facts observed as to the human remains found in long barrows. The first of these may be called the Successive Interments Theory. It is expounded by Professor Nillson[1], who, however, deals only with non-cremation, galleried tumuli. Now the very *raison d'être* of a gallery is the facilitation of successive interments; but the construction of a cremation barrow is incompatible with such an object. The second of these theories may be called the Ossuary Theory; and this, though combated by Professor Nillson, is not incompatible with his own theory, and, indeed, as regards chambered barrows, ought to have that theory combined with it. There is much evidence in its favour, as regards every variety of long barrow.

The third theory may be called the Human Sacrifice Theory, for which much evidence may be adduced from the practices of

[1] L. c. pp. 167, 168.

other nations, but of which the remains, as far as I have been able to judge, from British barrows do not furnish any proof.

In my account of one of the long barrows (Swell vii.), I shall describe how a skeleton was found lying upon the remains of two others, which had undergone some disturbance when the first was put in; and there is no need to labour a proof of the statement that the wish[1] of one man to be laid in the same tomb with another, his friend or his patron, is a *vera causa* for successive interments. But if the arrangement of the bones, the existence of the passages or galleries, and the feelings of human affection, as embodied in literature, and detectable, also, in ourselves, all alike speak in favour of the practice of successive interments, evidence of an equally cogent character can be brought forward to show that bodies were stored as they fell in by the death of their owners, and then buried or burnt simultaneously. The description of the structure of a cremation barrow proves the point of simultaneity, but till the theory of human sacrifice be disposed of, the acceptance of the ossuary theory cannot be held to be necessitated. Dr. Thurnam was the principal advocate of the theory[2] which accounted for a multiplicity of skeletons, of different sexes and ages, being found aggregated together in these barrows, by supposing that the majority of them were the skeletons of slaves or captives, slain to keep the chief company on his journey to, and in his sojourn in, the other world. That such rites were practised by the

[1] This wish was expressed by the prophet of Bethel in the simple injunction, 'Lay my bones beside his bones' (1 Kings xiii. 31), and is put into the mouth of Patroclus by Homer (Iliad, xxiii. 83, 84), in the beautiful lines—

Μὴ ἐμὰ σῶν ἀπάνευθε τιθήμεναι ὀστέ', Ἀχιλλεῦ,
Ἀλλ' ὁμοῦ, ὡς ἐτράφημεν ἐν ὑμετέροισι δόμοισι.

The imagery of the 32nd chapter of Ezekiel is borrowed from his recollection of successive interments.

[2] See 'Mem. Anthrop. Soc. Lond.,' vol. i., or pp. 28 and 68 of separate publication; 'Crania Britannica,' pl. v, l, lviii, lix; 'Archaeological Journal,' vol. xxii, June, 1865; 'Archaeologia,' xxxviii. p. 413, xlii. p. 25 seqq., 1869. In this latter place Dr. Thurnam has collected a large number of passages from ancient and modern writers, in illustration of the practice of immolating victims at funerals. To these passages I would add one from Tertullian, 'De Spectaculis,' xii:—'Olim, quoniam animas defunctorum humano sanguine propitiari creditum est, captivos vel mali status servos mercati in exequiis immolabant. Postea placuit impietatem voluptati adumbrare. Itaque quos paraverant armis quibus tunc et qualiter poterant eruditos tantum ut occidi discerent, mox edito die inferiarum apud tumulos erogabant. Ita mortem homicidiis consolabantur.'

ancients, that even in the time of Homer they were looked upon as repugnant to the moral sense of mankind[1], but that they retained vitality enough to give birth to the even worse atrocity of gladiatorial shows, we have evidence in abundance to prove. But we have no evidence to show that the bones of the slaughtered victims were allowed a place in the same cist, chamber, or urn, with those of the great man in whose honour they had been massacred. Achilles, indeed, gives precise injunctions[2] as to keeping the bones of Patroclus separate and apart from those of the twelve Trojan youths, the two dogs, and the four horses, slain and burnt with his body. Sometimes we find human bones scattered here and there, not only on the surface, but deep down in the mass of barrows, and I have thought that such bones, when this presence cannot be accounted for by any secondary or shallower interment, or any disturbance of a primary one, might perhaps have been parts of the skeletons of such victims. There is, however, a wide difference between leaving the remains of slaughtered victims lying about on the surface of the ground, and placing them inside a sepulchre, and the former of these modes of treatment is, I submit, the more natural one, and the more likely to have been adopted, for many reasons. The bones of a wife or concubine, who may voluntarily or half voluntarily[3] have given up her life at her master's funeral, may have been allowed to lie with his; but this supposition would not explain the facts of the numbers, and of the presence of both men and women in varying proportions in these interments.

Dr. Thurnam, however, based his support of the human sacrifice theory, not merely upon literary evidence, but also upon the appearances which the bones themselves from those barrows presented. Some of these bones are in the Oxford University Museum, viz. those from Ebberston[4], referred to as being calculated to 'convince the most incredulous;' and others in the Cambridge University

[1] See Iliad xxiii. 176.

[2] *'Οστέα Πατρόκλοιο Μενοιτιάδαο λέγωμεν,*
Εὖ διαγιγνώσκοντες, ἀριφραδέα δὲ τέτυκται·
'Εν μέσσῃ γὰρ ἔκειτο πυρῇ, τοὶ δ' ἄλλοι ἄνευθεν
'Εσχατιῇ καίοντ' ἐπιμὲξ, ἵπποι τε καὶ ἄνδρες·
Καὶ τὰ μὲν ἐν χρυσέῃ φιάλῃ καὶ δίπλακι δημῷ
Θείομεν.—Iliad xxiii. 239 sqq.

[3] See Anderson, 'Proc. Soc. Ant. Scot.,' May 13, 1872, p. 524.

[4] 'Mem. Soc. Anth. London,' l. c.

Museum I have been, by the kindness of Professor Humphry, allowed to inspect and examine. I have to say that, after repeated and careful examination of these bones, with the assistance of skilled anatomists, I am entirely convinced that they do not fairly bear the interpretation which Dr. Thurnam has put upon them. The 'perfectly sharp and clean' edges of the broken bones, and the 'porcellaneous character' of the fragments themselves, I happened one day to see reproduced by an accidental breakage which occurred in one of the skull-bones from the Market Weighton long barrow, and my eyes were opened to the necessity of no longer taking the theory in question for granted. On further examination, and after repeatedly submitting the Ebberston series, of which Dr. Thurnam wrote, l. c., to the inspection of others in whose judgment I had confidence, I was compelled to give the theory up[1].

What has compelled me to the acceptance of the Ossuary theory, is, firstly, its all but absolute indispensability for the explanation of the appearances met with in cremation long barrows; secondly, the fact that, in many receptacles for unburnt bodies, the arrangement which those bodies present is not that which they would have if they had been, one after the other, disturbed to make room for fresh immigrants; thirdly, the fact that the practice of storing bodies in provisional receptacles, *en attendant* a final sepulture, is one which has been practised all over the world; and, fourthly, a consideration of the circumstances which would be likely to throw a number of corpses upon the hands of a tribe in the Neolithic age, and the difficulties which those very circumstances would put in the way of their disposing of them at once.

The first three points need no further explanation; upon the fourth I will say a few words. At the present day, with all our means and appliances, severe cold produces a high mortality; even

[1] So, I think, has been Dr. Engelhardt, who has been quoted in favour of it. His last account of the great Tumulus at Borreby, in the 1872 edition of his 'Catalogue of the Danish Antiquarian Museum,' runs thus, p. 10:—'43 G. Inhalt einer Steinkammer bei Borreby auf Seeland, welche bis an die Decksteine mit unordentlich durcheinander gemischten Skelett-theilen von wenigstens 70 Individuen angefüllt war; mitten im Begräbnissraume fand man mehre gespaltene, und vom Feuer angebrannte Menschenknochen, und auf dem Steinpflaster des Bodens, unter Kohlen und Asche, gebrannte Menschenknochen und das Geweih eines Rehbock's, *welches letztere vielleicht vom Opfermale bei der Einweihung der Grabstätte herrührt.* Neben den Knochen im Grabe lagen Werkzeuge von Stein und Bein, Perlen und Topfscherben.'

in a small village several old people may be sometimes reported to us as all lying dead within its precincts at one time. If this is the case in modern England, what must have been the case in neolithic Britain? and in the presence of severe frost, and possibly deep snow, how was such a population as a tribe of the long-barrow period to get rid of its dead out of its sight? I owe a reference which throws much light on these questions to Dr. Joseph Anderson's paper in the 'Proceedings of the Society of Antiquaries of Scotland,' May 13, 1872, p. 526. This reference is to a passage in King Alfred's version of Orosius, where we read that it was the custom of the Esthonians to keep the body of any one who died one month, or even two months, or, in the case of kings, even half a year, before burning it.

In following up this line of illustration, I came upon the following lines relating to the manners and customs of the Russians, and addressed, from Moscow, to Spenser, by a lesser poet, one G. Turberville. They may be verified by a reference to 'Hakluyt's Voyages,' vol. i., ed. 1809, p. 433. Speaking of a Russian winter, Turberville says:—

> 'The bodies eke that die unburied lie they then
> Laid up in coffins made of firre, as well the poorest men
> As those of greater state. The cause is lightly found,
> For that in winter time they cannot come to break the ground.'

Returning from comparative civilisation to a consideration of what would be likely to happen in still earlier days, we may say that, out of a number of bodies stored up till it should be possible or convenient to deposit them finally in a tumulus, some would become more, some less, some perhaps entirely disjointed; for the practice of stacking or storing the dead, though originated probably by the necessities of cold weather, would be continued, as well-recognised principles would lead us to expect, irrespectively of times and seasons, when it was once well established. Thus the partial retention and partial loss of the natural connections of the bones observed in these barrows would both alike receive an explanation, and be seen to depend upon the greater or less resistance which their ligaments had offered to the attacks of putrefaction[1].

[1] M. Arthur de la Borderie, Député à l'Assemblée Nationale de France, in his work, 'Les Bretons Insulaires et les Anglo-Saxons du v. au vii. Siècle,' when giving

I will now commence a detailed account of the examination of three long barrows, situated near the village of Nether, or Lower Swell, near Stow-on-the-Wold, in the county of Gloucester. Three persons, the Rev. David Royce, Canon Greenwell, and myself, were concerned in their examination. A large part of the investigation of the barrow first explored, and hereinafter spoken of as Swell i., was superintended by Mr. Royce alone, in the years 1867 and 1868; and to his report of what he observed in it I am greatly indebted for much of what relates to its structure. To his zeal and intelligence, exercised for a period of no less than eight years, we owe the preservation not only of valuable records of facts, but of many osteological and other relics which might otherwise have been scattered and lost. To Canon Greenwell's suggestions and advice, as well as to his very efficient help in other ways, and notably in the examination of the third barrow (Swell vii.)[1], at

(p. 622) a translation from 'Les Bardes Bretons,' relating to the death of Kendelann, puts in italics the following words:—'*Son squelette sèche encore au coin du feu.*' And in commenting upon them he says:—'Est-ce à dire que les Bretons eussent conservé jusqu'alors le vieil usage, décrit par Strabon, de faire dessécher les os de leurs parents et de les garder dans un coffre au coin du feu domestique?' I have not succeeded in verifying this quotation, which appears to have exceedingly important bearings on the subject of ossuaries, or at least upon that of the practice of keeping the dead body accessible for some time after death, a proceeding which terminates usually in its removal to an ossuary.

The following references to statements as to the use of ossuaries in ancient and modern times may be found useful:—

Phineas Fletcher, 'Eclogues,' p. 10, ed. 1771, 12mo.
G. Turberville, in 'Hakluyt's Voyages,' vol. i. p. 433, ed. 1809.
Falkner cit. Cunningham, 'Nat. Hist. Straits of Magellan,' pp. 146, 147.
Lukis, 'Archaeol. Journal,' 1845, vol. i.
Anderson, 'Proc. Soc. Ant. Scot.,' May 13, 1872, p. 526.
Nillson, 'Early Inhabitants of Scandinavia,' ed. Lubbock, pp. 162, 163.
Grey, 'Journals in North-West and Western Australia,' i. 257, 1841.
Eyre, 'Journals in Central Australia,' ii. p. 344, 1845.
Finlayson's 'Mission to Siam,' p. 235, 1826.
M. Boye, 'Proceedings of Soc. Ant. Lond.,' ii. ser. iii. p. 310.
'Schoolcraft,' i. 80, 102.
D. Wilson, 'Prehistoric Man,' 1865, p. 488.
Musters, 'Journal Anthrop. Inst.,' Lond., i. 2, Oct. 1871, p. 201.
McDonald, Ibid., p. 214.
McDonald, Ibid., ii. 2, Oct. 1872, p. 176.
Lubbock, 'Prehistoric Times,' ed. 1872, p. 269.
Wood, 'Cruise in South Seas,' p. 115, 1875.

[1] The three barrows have been numbered Swell i, Swell vi, Swell vii; the numbers intervening between i. and vi. having been assigned to other barrows not treated of here.

which I was only able to be present on a very few occasions, I owe a large debt.

Swell i.—The first of the three barrows examined is situated in a field which has been under cultivation from twenty-seven to thirty years, though it is still known as the 'Cow Common.' The other two barrows were found by us in 1874 to have the heart-shaped or 'horned' eastward ends, which are so well known to us from Dr. Anderson's[1] descriptions of the 'horned cairns of Caithness,' as also from Dr. Thurnam's[2] accounts of the tumuli at Uley and Belas Knap, in this very county of Gloucester. There is, as it appears to me, a great probability that the barrow, Swell i., was originally constructed with the same outlines and contour as these other barrows; but the eastward end had been much reduced in size by removal of the stones of which it was made up, to fill up an adjacent quarry, in the years 1867–1868; and in 1874 some indistinct traditions as to the existence in former years of curved walling at that end were the only main specific basis—as distinct from the general likelihood arising out of its other still remaining points of resemblance to typical horned barrows—for holding that it probably had been one. Making allowances, however, for the demolitions which had taken place in the years 1867 and 1868, and, possibly enough, in years long before them, we shall not be far wrong in saying that the extreme length of the barrow from E.S.E. to W.N.W., the direction of its long axis, was from 150 to 155 feet; and that its breadth at its eastward end was 77 feet; at its highest point, a point very near to the line occupied by the chamber which, as will be seen, gives the chief interest to the barrow, 69 feet; and at its westward end, 40 feet. The greatest height of the barrow, as at present existing, is about 5 feet. The ground occupied by the barrow falls slightly from the west eastwards.

In 1867, and previously to the removal of the eastward end, the Rev. David Royce discovered in the barrow a chamber of about 3 feet square, as reported, but probably of even smaller dimensions, with a gallery or passage leading down to it at a point

[1] See Anderson, 'Ancient Remains of Caithness;' 'Mem. Soc. Anth. Lond.,' vol. i. p. 474, 1865; 'Proc. Soc. Antiq. Scotland,' 1866–1868.

[2] See Thurnam, 'Crania Britannica,' Pl. v; 'Mem. Soc. Anth. Lond.,' 1865; 'Archaeologia,' vol. xlii. p. 209.

close to its northern boundary line, and 55 feet from its east end. In this chamber were found three skeletons, and in the immediate neighbourhood, either at the same time or in 1874, parts or the whole of five more skeletons, making a total of eight, for whose reception or honour the tumulus had been piled together. The osteological remains, and the surroundings in which they were found, will be described in greater detail further on. The barrow was found to be bounded (irrespective of talus) on its north and south sides by a wall made up of the oolitic flags of the district, laid in horizontal courses; the presence of a wall was not made out at the west, nor, as already stated, at the east end. The wall was about 2 feet 3 inches in height on the south side, but was considerably less on the north, where it was in some places reduced to as few as three or four courses of its constituent flags. The north wall turned inward, to form the passage just mentioned as leading to the skeleton-containing chamber. The walls of the chamber consisted of flagstones of much larger size than those used for forming the boundary walls of the tumulus, the largest being as large as 3 feet 6 inches by 2 feet 4 inches. Some of these stones had been set on edge; some, probably, had served as covering stones. The walls of the chamber thus constituted were set inside the walls of the passage formed by the inward prolongations of the north wall. But this barrow was broader at the level of the chamber than at that of the extreme eastward end; that is, in other words, it was spindle-shaped, instead of being, as is commonly the case in long barrows, club-shaped, or, as in the horned cairns, heart-shaped, with the broader end eastwards. It is true that on measuring the entire mass of talus which the rubble had formed at the east end, the space thus curved was found to be 6 or 7 feet wider than the transverse measurement of the barrow, taken across the chamber. The limitary walls, both north and south, took a set inwards as they passed eastward from that line. Mr. Royce has suggested that these portions of the limitary walls do not represent the original boundary walls of the barrow for the 55 feet or so from its eastward end, but that the original outer wall ran along a line more or less continuous with that of the walling to the westward of the chamber, and that it has been removed in some unrecorded denudation of the mound. The more internally placed and still persistent walls might be but layers of stone,

arranged by the original builders of the barrow for purposes of self-protection against the slipping and sliding of the rubble; just as we often observed our modern labourers arranging the stones of these barrows while we were exploring them, the same considerations of personal convenience having operated upon neolithic, as they do upon modern, stone-heavers[1].

This supposition would remove the stumbling-block constituted by the representation of a long barrow tapering towards its eastward end. A ground-plan which we made represented, in continuous lines, the actual facts, as seen and measured by us; and a plan of a barrow with a double wall at its east end, such as the Uley barrow appears to have been[2], may represent those facts as they were previously to interference[3]. The wall of the passage which ran outside the eastward wall of the skeleton-containing chamber, I think, from a comparison of my own notes taken on the spot in 1867 with my observations made in 1874, must originally have been continued southwards as far as the south wall of the barrow. Looking at the barrow in 1867, I noted that a single wall, starting from the south side, 'crossed the width of the heap to the opposite side, where the "cist" was;' and a MS. note of Mr. Royce is to very nearly the same effect, viz. that 'there was an appearance of walling in the very centre of the barrow, and almost through it in a line with the east end of the cist; the face of the wall was towards the west, not east.' A segment of this wall, about 4 feet long, existed in 1874, in continuation of the passage wall southwards from the chamber it bounded; and another segment, about 2 feet long, took origin opposite this segment, and was prolonged northwards from the

[1] This observation of the practice of modern labourers should put us on our guard against assigning too much importance to, or searching too curiously for, a meaning for every line of walling met with in barrows made of slate-shaped stones. As regards the outer boundary walls even, the mere necessities of the case will account for the greater definiteness which they possess at the sides and west ends; though, it is true, they do not account for the peculiar heart-shape which they assume at the east ends of such barrows. For the double curve thus described, the fact that an entrance to a doorway, or gallery, or passage could thus be made with facility, may possibly account. And this contour might, on the well-known principle of 'survival,' be retained even when, as in the Swell barrows, there was no gallery nor chamber at the east end.

[2] See 'Crania Britannica,' Pl. v; 'Archaeologia,' xlii. p. 49, ibique citata.

[3] Compare Dr. Anderson's Plan, vii, 'Proc. Soc. Ant. Scot.,' l. c.

southern wall; but the intervening length, to which the testimony of one of our workmen spoke, as well as my own notes and those of Mr. Royce, had disappeared in 1874. What, however, is certain is, that westward of a line which we drew in the ground-plan, the barrow was crossed from north to south by a zone or strip, varying in width from 2 feet 8 inches in the region of the chamber to 3 feet 6 inches in the middle line, and differing from all other segments of the entire length of the barrow in the important particular of lodging eight human skeletons. In the chamber contained in this transverse zone were found, in 1867, parts of three skeletons, two being skeletons of adults, and one a skeleton of a child. At the same time a third adult skull was found immediately to the north, and a fourth immediately to the south of the chamber; whilst outside the chamber again, but at a greater distance to the south than the skulls, were found two headless bodies, which Mr. Royce found 'one about the centre of the barrow, west of the supposed central walling, and one more to the south-west.' Working in 1874 in this transverse zone, we found, at points varying from a spot a little south of the middle line of the barrow, four skeletons, one of an aged woman (described below under label 'Swell i., 22-9-1874'), one a male skeleton without a head, and two skeletons of children. Portions of the headless skeleton found by us in 1874 fitted with fragments of bones found and given to me by Mr. Royce in 1867; and the later headless skeleton, therefore, may be supposed to be identical with one of the two discovered earlier, which one of its discoverers did not think it worth while to remove in its entirety. But what is of consequence is to note, that after a very careful examination of all the bones obtained from the chamber, and from the transverse zone crossing the barrow in the meridian of the chamber in the year 1867 and in the year 1874, we proved that there was no proof in the entire assortment of the existence of more than eight skeletons, three of which had belonged to children, and five to adults. It is well known that many large barrows were erected for the purpose of containing only just such a chamber as the one found in this one, and for lodging only just as few bodies as—or, indeed, often fewer than—the number found here. But it is also well known that many of these long barrows contained more than one, or even two, sepulchral receptacles, 'chambers,' or 'cists;'

and such an additional receptacle for additional dead may have been constituted by a somewhat enigmatical structure found in 1868, but destroyed before 1874. This structure, when discovered April 10th, 1868, during the process of carting away the eastward end of the barrow, was described as being a 'diagonal oval chamber, built of small slates, after the manner of the inclosing outer wall,' and as being 6 feet by 4 feet 8 inches in transverse measurements. It contained no upright flags, and was 25 feet nearer to the east end of the barrow than the chamber already described, and a little to the north of the middle line. When discovered, it contained the following relics: the distal end of the left radius of an adult man; the mid and ungual phalanges of an adult human subject; the clavicle of an infant; the upper molars of an ox; the last lower molar of a sheep; and the phalanx of a small carnivore, probably a weasel, as verified by Professor Owen for Mr. Royce, April 27th, 1868; and two flint flakes. Though the fact of this penannular structure having been so far away from the line of the chamber already described makes it improbable that the two bodies represented by the bones just mentioned could have been of the number of eight found to the west of that line, it is of importance to note that there is no osteological impossibility in the way of considering them to have so belonged to them. But in favour of their independent origin there is an additional fact, in the possession by me of a very much worn human temporal bone, which can scarcely have belonged to any of the five adult skeletons already spoken of, but which came from some part of this barrow, it is uncertain which.

If much is left in comparative uncertainty as to the bones contained in this structure, much more is left in uncertainty as to the interpretation of the structure itself. It is possible that when discovered in 1868 it was even then but the remains of a much larger, or, at least, a more perfect structure; and that larger or more perfect structure may have been either the remains of a heart-shaped or horned east end, or it may have been the remains of a chamber placed much as certain chambers were placed in the chamber-end barrow at Uley, already referred to as described by Dr. Thurnam. But it is also just possible that it may have been simply a stretch of walling erected as a 'block' to shore up the loose rubble, of which the great bulk of the tumulus was made. Similar structures,

it should be said, have been used for sepulchres in Scottish tumuli. But it is unprofitable to speculate further upon the real meaning of this lost structure. We tread on much surer ground in dealing with the locality in which the eight more or less perfect skeletons were discovered. The way in which the skeletons, three in number, were found, in 1867, to be arranged within the chamber, itself a space which was reported to me as being but 3 feet square, and which was in all probability of even less size, was described to me with much precision as follows:—There were in the middle the bones of a child; all round the north side of the cist were coiled the bones of one of the two adults, with the vertebrae *in situ*, and the legs protruding through a hole in the cist to the outside of it; whilst in the south-east angle of the cist was the other adult, 'sitting up,' or, as it was otherwise expressed to me upon another occasion, 'squatting,' with the head resting on the ribs. The covering stones, the existence of which was not noted, as also some of the side stones, must have got displaced, and the chamber had got filled with rubble.

From the chamber there came also to me, in 1867, the jaws of a very young pig, those of a cub-fox, and a part of the occipital bone of a sheep. Some other bones, of ox and of sheep, were sent with them, and may have their presence referred to the practice of feasting at graves. Bones of oxen and sheep were found in various parts of the barrow to the westward of the transverse ossiferous zone; and some of these bones, from being crumbly in consistence, and, like the human bones from the chamber and its neighbourhood, much stained with the manganic oxide, may be supposed to be of the same age. No other human bones besides those already specified were found in the barrow. Large quantities of ashes and charcoal were found here and there, both at the east and west end of the barrow. The structure, indeed, of the eastward end of the barrow, removed in 1867–1868, was reported to us as having been quite different from that of the west, and this mainly by virtue of a line of deposit of ashes along and on both sides of its centre line. This deposit was said to have consisted of heaps of ashes lying on stones, with stones again laid over them. The heaps of ashes were not in a continuous line, but were, as reported, separated by intervals of 10 feet or so. The ashes themselves were reported as being of a 'pinkish, fleshy colour, not at all like the ashes from

turf-burning, and as having no grit in them, as field ashes usually have, but feeling soft and greasy when taken between the thumb and finger.' Blacker ashes were also found to the north of the central deposit; and in a deposit from 8 to 10 feet to the north of the central axis were found two serrated flint flakes, stones reddened and calcined, and a splinter of glass. The presence of such an article as this last shows that the eastward end of the barrow must have been subjected to some comparatively recent disturbance—at all events, of a kind which would favour the descent of a fragment of such a modern substance as glass. As far as I could judge from excavations made in 1874, the structure of the barrow was, with the exception of the ossiferous zone, and disregarding accidental disturbances made possibly at very different times, essentially one and the same from one end to the other; the mass of the barrow consisting of slates and rubble arranged in a slant from north and south outer walls respectively, so as to meet in the middle line—as one of the labourers, employed in 1868 in carting them away, expressed it, 'like the roof of a house.' The slanting stones were supported externally by the boundary walls, similar walling being intercalated here and there internally for the same purpose. The converging slopes of flags and rubble had been broken into here and there in the westward half of the barrow; and in exploring one such interruption of its continuity, about 20 feet to the westward of the skeleton-containing chamber, I came upon a few bones of ox, of ancient date, mixed up with a good deal of blackish earth, amongst the rubble. Mr. Royce found a considerable number of such interruptions of the line of the barrow in its westward half, ashes, and bones of lower animals, being found in them. Some of these interruptions of, or alterations in, the arrangement of the component elements of the barrow, may have been coeval with it; those at the east end may have been later—I am inclined to think very much later—than that period. In this matter Mr. Royce does not agree with me.

There was found in this barrow a considerable quantity of pottery, some of a coarse blackish kind, resembling that obtained by me in considerable quantity from a long barrow at Market Weighton, and like that, also, in having been intended for domestic uses; and some of the same black and red paste, but cigar-shaped,

and intended, as Sir H. Dryden pointed out to me, for use in pot-making, as in Brittany. The pottery was reported to have come from parts west of the middle of the long axis of the barrow, nearer its north than its south wall, and from no very great distance downwards in it. A coin of Constantine was found in the same locality, but very near the surface.

It may now be well to put distinctly on record what we personally observed in 1874, whilst making certain sections to clear up points left undecided by what had been done in 1867 and 1868.

In clearing out the space already spoken of as the transverse zone, containing the ossiferous chamber, and that part of it which ran southwards from the chamber, parts or the wholes of four skeletons were come upon. And the first points, perhaps, to be noted about them are that they were not laid upon the natural soil, as has sometimes been observed to be the case—as, for example, in another long barrow in this neighbourhood—but that they always had some slaty rubble interposed between them and the soil, and that two of these bodies lay to the south of the long axis of the barrow. These facts may seem to some to be an argument in favour of Professor Nillson's view[1] of the bodies having been introduced at successive periods into such tumuli, and of explaining thus those marks of disturbance which have induced other writers to have recourse to the hypothesis that these ancient, like certain modern savages, used their tumuli as ossuaries. The first body found was that of an aged woman, lying (on the right side?) in the contracted position, with the vertebrae *in situ*, about 4 feet 6 inches from the top of the barrow, and from 2 inches to 4 inches from the natural surface of the ground, which was separated from the skeleton by a layer of stones. In front of the legs of the woman, and quite close to them, was the skeleton of a child, in possession of the full milk dentition. Charcoal lay in small quantities all about the bones of the two human subjects, and mixed up with them were the bones of voles. As the trench was carried up towards the chamber, the bones of another child, considerably younger than the former one, were found scattered about in it; and, finally, in the nearer neighbourhood of the chamber was found

[1] 'Primitive Inhabitants of Scandinavia,' ed. Lubbock, p. 168.

a considerable part of a headless male skeleton lying on its right side—as there are indications to prove, from the wear of the bones (irrespective of notes taken or not taken at the time), that nearly all the skeletons from this chamber, and its neighbourhood, were laid. The head of this skeleton, if it was not buried in the headless condition in which we found it, must have lain or been propped against the eastward wall of the zone or trench. The very cramped position which it would thus have occupied may seem to favour the notion of its having been thus headless when first deposited, a notion which the discovery of heads buried separately in other barrows [1] might, in the absence of other considerations, serve to confirm. The patella, tibia, and fibula were *in situ*, as well as the clavicle, first rib, and the upper end of the humerus of the right side, and some of the dorsal vertebrae; but much breakage had taken place, and parts of a fibula and tibia of the left side, found in relation with these bones by us in 1874, were found to be parts of bones taken up by Mr. Royce in 1867, and given by him to me, showing that much disturbance had taken place then, and render it unsafe to suppose that any of the dislocations of the trunk bones, or indeed the separation of the head, may have dated from the time when the body was first put into the barrow. With what was actually seen by us in 1874 must be coupled what was reported to us from 1867, and this went to the effect that two headless bodies were found in this transverse strip of the barrow, west of the central walling, and that one of these lay about the centre of the barrow, and the other further to the south-west; whilst all the skulls, five in number, discovered in 1867 were in, or in the immediate neighbourhood of, the cist. The cist or chamber itself contained three bodies in 1867 undisturbed—at least to any recognisable extent. The fact that some of the entire number of eight bodies were found at a considerable distance from the skeleton-containing chamber, and that they were found without any of the upright flagging with which those of the other skeletons were placed; and the fact that two skulls, which may be supposed to have belonged to the two headless skeletons, were found placed close to the chamber, one on its north, the other on its south side, seem, when taken together, to indicate that the three skeletons in the chamber were interred at one time, but that time one subsequent

[1] See Prof. Unger, 'Götting. Anth. Verein,' i., 1874, pp. 32–33.

to that at which the bodies found headless were interred, and that the skulls of these latter were removed at that time from their natural connections, and placed near the chamber. It is, however, plain that such an explanation as this combines the ossuary theory, which it would employ for the skeletons found undisturbed, with the view of holding that these interments are to be considered the successive interments of a family powerful enough to command the use of a barrow, which view it would employ for the skeletons found at a distance from the chamber. It is possible that it may be right so to combine these views.

Osteology and Craniography.—A few general remarks may be made as to the entire collection of human bones obtained from the long barrow, 'Swell i.,' before we proceed to give in detail the craniography of the skulls which have admitted of reconstruction. We have definite proof of the presence of eight skeletons in this barrow; of these eight skeletons, three belonged to children, and five to adults. Of the five adults, four had been aged; of the four, two had been men, two women. The fifth adult had been a man of from twenty-four to thirty years of age. Of the three children, one was about two years old; the other two were about seven months at most. The four skulls which belonged to aged adults have been reconstructed. The skulls of the two adult females will be observed to differ greatly in size, the one being very large, the other very small; whilst the two adult female skeletons resemble each other in a point eminently characteristic of savage life—to wit, in showing that their owners were disproportionately short in stature, as compared with the male members of their tribe. The leg bones of the females give them a stature of 4 feet 10 inches and 4 feet 9 inches, against a stature of 5 feet 6 inches in the males; and a similar tale is told even more emphatically by a comparison of their respective collar-bones. The average difference between the male and female stature[1] of civilised races is about half this amount.

In two cases of the aged adults considerable loss of teeth had occurred before death; in the two others, precisely the reverse was the case. The young man, as might be expected, had retained his entire complement of teeth—in the upper jaw, at least, which alone we recovered in his case. The male lower jaws have the alveolar

[1] See 'Archaeologia,' xlii. p. 447.

portion of the mentum relatively larger than in modern races of Europe; and in two lower jaws, one belonging to a male, the other to a female adult, the mental foramen is placed further back than is usual in European jaws. The tibia of four, if not of all the five adult skeletons procured from this barrow, are more or less what Professor Busk[1] has called 'anteriorly platycnemic.' Though the femora from this barrow were not markedly carinate—which, indeed, we should not have expected to find them to be, as correlated with this variety of platycnemic tibiae—all the bones had their muscular ridges well pronounced and defined, as though their owners, if not of very great stature[2], nor, as is probable, of the very poorest grade amongst a savage tribe (all of whom, however, are always poor), were yet in the habit, whether from choice or necessity, of using considerable muscular force. Several of the humeri, for example, had the deltoid ridge very strikingly developed, as though their owners had laboured at lifting the stones of the barrow which was one day to cover them. One of the humeri, it may here be noted, and that, as M. Broca has noted[3] to be usually the case, a female's, had an olecranic perforation. Two scapulae, with unanchylosed acromial processes, were observed here, a fact of small consequence by itself, but pointing, when taken in connection with others, to the probability of blood-relationship having existed between the several occupants of the tumulus.

In their texture, colour, and manganese discoloration, all these bones resemble each other pretty closely, and convey to the mind a strong impression of their antiquity.

Craniography.—Swell i. (a).—Skull of woman, past middle period of life. To this skull probably belong an upper and a lower jaw, and a femur, labelled accordingly, and giving a stature of 4 feet 9 inches; as also a couple of very small clavicles, and a very slender radius.

Ext. length, in inches	7·65	Circumference	22
Ext. breadth (approx.)	6·0	Least frontal diameter	3·9
Ext. height (approx.)	6	Greatest frontal	5·1

[1] See 'Journal Eth. Soc. London,' Jan. 1871, p. 459.

[2] For the large size of the chiefs in savage tribes, see Whitmore, 'Contemp. Rev.,' 1873, p. 392; Brenchley, 'Cruise of the Curaçoa,' p. 137; Erskine's 'West Pacific,' pp. 155 and 240; Forster's 'Observations,' p. 229; Ellis's 'Polynesian Researches,' ii. 26.

[3] 'Mémoires,' ii. p. 366, 1874.

Ceph. ind. (approx.), but the skull is broader as restored than it was in nature . . .	78	Interangular lower jaw . .	3·8
		Ant. post. index[1] . .	90 : 195
		Basilar angle (approx.)[2] . .	10

This, though a very large calvaria, must nevertheless be a woman's, not only for the intrinsic reasons of the verticality of its forehead, the comparative verticality of its parieto-occipital region, the general smoothness and roundness of all its outlines, and the small size of its supra-orbital and mastoid ridges, but also for the extrinsic reason that from the cist and its neighbourhood evidence of four other adult bodies is before us, one of these being a woman's skeleton nearly entire, the other three being undoubtedly male skulls, accompanied, however, by a second set of adult female bones, which can only be referred to this skull.

The first thing to be remarked, perhaps, is the enormous difference of size of the two female skulls, and the consequent unsafeness of saying that men and women are or are not of much the same size in savage races. There is some indication of a post-coronal furrow in this skull, to which some internal thickening corresponds, as is usual. This skull would be spoken of as belonging to the Sion types, just as skull (*c*) would be referred to the Hohberg type of His and Rütimeyer.

The lower jaw, which with much probability can be referred to this skull, is feeble, rising up from the level of the mental foramen forwards, which foramen, however, is further forward, being in the plane of the first premolar, than in some other lower jaws of this series. The teeth are much and horizontally worn; the wisdom teeth were never evolved, in correspondence with which fact the smallness and absence of wear of the wisdom teeth, in an upper jaw probably belonging to this skull, are to be noted. The ramus forms an oblique angle with the body of the bone.

Swell i. (b).—Skull of a man past the middle period of life. The cranial bones are thick, and the pits for the Pacchionian bodies well developed. To it probably belongs an old upper jaw. The lower

[1] By 'antero-posterior index' is meant the relation held to the extreme length by that part of it which lies anteriorly to a line drawn as a tangent to the anterior border of the auditory foramen, and cutting the line of extreme length at right angles. It is easily taken by fitting an indicator to M. Broca's 'cadre à maxima.' It shows the degree of frontal development, and, *per contra*, of occipital dolichocephaly.

[2] Taken with M. Broca's Goniomètre occipital. See 'Rev. d'Anthropologie,' ii. 2, p. 202, 1873.

jaw, probably belonging to it, indicates age by the wear of its teeth and the loss of all its molars, except one on each side. The jaw is somewhat atrophied in consequence of this, and the ramus lies obliquely to the body of the bone.

Ext. length in inches	7·6	Occipital arc	5·0
Ext. breadth	5·4	Entire arc	16·8
Vert. height	5·8	Ceph. index (approx.)	70
Absol. height	5·7	Basilar angle	30
Frontal arc	5·2	Ant. post. index	110 : 192
Parietal arc	5·6	Basi-cranial axis	4

The high basilar angle of this skull shows that if it had retained its maxillary bones and teeth it would, in all probability, have rested upon its occipital condyles and teeth when placed on a flat surface. Having a high figure for its vertical arc, coupled with the ordinary length of basi-cranial axis, its cranial vault has been rotated forward so as to throw the bregma far (viz. $\frac{8}{10}$ths of an inch) in front of a line drawn from the auditory foramen upwards at right angles to a horizontal line. The highest point in the vertical contour is 2·1 posterior to the coronal suture, and from this highest point the parietals slope over, so as to form an equable incline with the superior occipital squama. There is a very large occipital spine which hinders the exterior surface of the skull from showing any great difference between the glabello-postremal and the glabello-inial diameters. The conceptaculum cerebelli, though sloping upwards, is yet far from approaching the vertical line as nearly as in typical brachycephalic skulls. The forehead slopes gently from the line of the largely-developed supraciliary ridges to that of the frontal eminences, after which it passes, with greater obliquity, into the upwardly-inclined plane of the anterior halves of the parietals. The frontal is markedly carinate, its mesial elevation passing continuously onwards into the still better marked parietal ridge, on either side of which a post-coronal depression is visible exteriorly, corresponding with an inwardly-looking convexity of the inner skull table. It presents a well-marked pentagonal outline when viewed in the occipital norma, the parietal tuberosity being nearly as well marked as the mesial vertical carina.

Swell i. (c).—Netherswell, Dec. 1867.—Strong man, past middle period of life. To this cranium may probably be assigned the femur, measuring 18·4 inches, as also the bones found *in situ*, September 22nd, 1874, but without a head. The other two male

skulls are either too old or too young to have these bones assigned to them; the stature of this man would, therefore, have been 5 feet 6 inches.

Glabello-inial length	7·9	Parietal	5·1
Ext. length	8·2	Occipital	5·2
Ext. breadth	5·3	Ceph. index	64
Vert. height	5·7	Ant. post. index	115 : 210
Least frontal	4·1	Circumference (approx.)	22·3
Frontal arc	5·2	Basilar angle (approx.)	32

Typically dolichocephalic skull—Orthognathous.—Large supraciliary ridges, from which forehead slopes only slightly. The highest part of vertical contour is at coronal, when the head is held with the vertical line joining coronal suture and auditory meatus. The parietals slope very gradually to the occipital squama, which possesses a considerable length, looking vertically. In the norma lateralis nearly the whole of the parieto-occipital suture of that side comes into view. In the vertical view this skull is typically elongato-oval; there is some slight constriction immediately behind the region of the coronal suture; the broadest part of the skull is below and a little in front of the parietal tubera. The skull walls are compressed from side to side below the level of those eminences, and taper rapidly to the occipital squama. The sagittal suture is partially obliterated. Viewed from behind, the roof of the skull falls rapidly from the middle line to the region of the parietal tubera, and its walls converge again in the region of the squamosal. The orbital and supraciliary ridges occupy a plane anterior to that occupied by the commencement of the brain-case. The mastoids and temporal ridges are well developed.

The palate is narrow, deep, elliptical; the teeth much worn, in a slanting, not a horizontal direction. To this skull may, with much probability, be assigned a lower jaw, with teeth similarly worn. Its angle is well defined and flanged outwards, and the body of the bone is emarginated anteriorly to it. The mental prominence is well marked, and, though narrow, is divided into two processes, one on either side. The alveolar part of the front of the jaw is deep. The mental foramen is further back than is usual in European skulls, being in the plane of the second premolar.

Swell i. (d).—Part of frontal, and right molar and maxillaries of a strong young man, aet. twenty to twenty-four. The frontal appears to have been vertical up to the tubera, which are low down, and then to have sloped very gradually to the coronal suture. The temporal ridges are greatly developed.

Orbit width	1·65
Orbit height	1·3

The wisdom teeth are in place, but have been very little used. The supraciliary ridges are large, but are not underlaid by sinuses.

Swell i, 22-9-1874.—Imperfect calvaria of old woman, 4 feet 10 inches in stature, dolichocephalic both by contour and by measurement. It contrasts very markedly, as regards size, with the other female skull procured from this barrow, into the inside of which it could be put, though its owner was an inch taller (4 feet 10 inches as against 4 feet 9 inches) than the owner of skull in Swell i. (a). This skull might be taken as a fair specimen of the River Bed type of Professor Huxley, the larger as a fair specimen of the Sion type of His and Rütimeyer.

Ext. length	7·1	Occipital	4·2
Ext. breadth (approx.) . .	5·0	Cephalic index	70
Vert. height	5·3	Femur	16
Frontal arc	4·9	Ulna	9·2
Parietal	5·4	Stature . . .	4 ft. 10 in.

The forehead is vertical; the highest point in the vertical contour lies about an inch posteriorly to the coronal suture; the posterior half of the parietal curves evenly into the slopes of the superior occipital squama. The cerebellum was much overlapped by the posterior cerebral lobes. The lower jaw is feeble. The mental foramen corresponds to the interval between the second bicuspid and first molar. The teeth are very much worn down, and there are two or three alveolar abscess-cavities in the jaw. One very large one occupies a great part of the molar region of the left upper maxilla.

Many of the vertebrae, from the cervical downwards, are beset with exostoses, but they are not anchylosed. The tibiae were not sufficiently well preserved for me to decide whether they were platycnemic, as were all the other four adult tibiae. The femur is very much flattened in the region of the insertion of the glutaeus

maximus, but there is no flanging out beyond the plane of that insertion. This flattening is not rare in ancient skeletons with skulls of very various kinds. It has been noted by Holder[1] as existing in his 'Ligurian' type. Only a few of the bones of this skeleton have become stained with manganese.

Swell vi.—*Long Barrow in field known as 'Long Ground,' two miles west of Netherswell, Eyford, co. Gloucester.*—In the field next beyond the one lying on the left side of the road leading from Netherswell to Naunton, at the bottom of the first descent, and about two miles from the former place, we—that is to say, the Rev. David Royce, Canon Greenwell, and myself—examined, in September, 1874, a long barrow of very similar form to the horned tumuli described by the late Dr. Thurnam[2] and by Dr. Joseph Anderson, from parts of Great Britain as far apart from each other as Gloucestershire and Caithness respectively. A plan was taken by Sir H. Dryden, Bart., who visited the spot, and gave us the advantage of his experience. It is sufficient here to give the following particulars:—The broader end of the barrow was at E.N.E., and here the outlines of the two horns[3] were distinctly traceable; the westward end of the barrow had suffered more from agricultural operations than the eastward. The distance, however, from this end, as restored, to the centre point of the eastward end, was 108 feet. The distance between the tips of the two horns was 44 feet; the barrow tapered gradually from this, its extreme width, to a width of 24 feet at its westward end. The height of the tumulus was about 4 feet, on an average, but allowance must be made for possible diminution by farming processes. The two horns were not symmetrical, the north-eastern being the longer and slenderer. The limiting wall was made of the slate of the district, being Stonesfield oolite, arranged in about fourteen horizontal rows, and forming a boundary about 2 feet wide and 1 foot 9 inches high. The body of the barrow was formed of stones, with a general inclination inwards towards the middle line from either side; and in the middle line, here and there, a blackish seam was to be seen, due, I think, to accidental detritus of vegetable and other rubbish, during disturbances, in past time, of the barrow.

[1] 'Arch. f. Anthropologie,' ii. p. 54.

[2] See above.

[3] The Gloucestershire tumuli appear to differ from the Scottish, in having only two horns, and those at the eastward end.

This barrow contained four more or less disturbed 'chambers,' or 'cists.' In the case of the first of these receptacles of the dead, which was the one which had suffered most in the way of disturbance, there can be no doubt that the term 'chamber' is the right one to apply to it, as the limitary wall of the barrow formed a passage leading down to it; but in the case of the other three, this passage was not found to exist, and though the end stones, which give a 'cist' its distinctive character—that, namely, of being closed on all sides—were not found *in situ*, it is easy to understand how they may have been the first to be moved, when the plough was first driven across the barrow, at right angles to the long axis of which they stood.

The 'chamber' having been most completely ruined, we can with certainty depose to the presence of no more than two bodies as having been found, represented by fragments in its immediate neighbourhood, and as having, consequently, with some likelihood, been once contained in its interior when intact. One of these had been an adult, one a child, with the milk dentition only in place. The bones of the adult were discoloured with manganic oxide, as were those of an ox and horse found with them; those of the child were not.

Of the three other receptacles, 'cists,' or 'chambers,' for the dead, the first examined contained portions of the bodies of two adults and four children, together with the larger part of the skeleton of a young dog, and some other domestic animals' bones. The second contained portions of ten skeletons, all of which, with one exception—the skeleton of a boy or girl—had belonged to adults, whilst the fourth contained only one skeleton, that of a person between twelve and sixteen, with whom a fragment of coarse domestic pottery was found.

September 25, Friday.—The first operation in the way of examining this barrow took the shape of cutting a trench across its eastward end, at right angles to its long axis, at a level which subsequent examination showed to be about 8 feet to the westward of the central concavity of the horned eastward end.

At about 17 or 18 feet westwards from the centre point of the eastward end were found some bones of a child, with the milk dentition in place, about 2 feet or half-way down in the barrow. Parts also of an ulna, of a tibia, of the phalanges, and of both

temporals of an adult, were found at about the same distance from the east end, and at a point a little south by west of the middle line. In the middle line of the barrow at this distance from the east end was a blackish seam of about 6 feet 6 inches in width, containing bones, but limited in the eastward direction by masses of stones, under which also were found a few fragments of human bones, adult and young. Amongst the bones from this part of the barrow was one fragment of burnt bone, possibly human, as well as some teeth of ox and horse. These teeth, as also the human temporals, were stained by the manganic oxide. These appearances were difficult of interpretation until we came upon the ruins of a 'chamber,' about 6 feet or so further to the north-west, the destruction of which, and the scattering the contents of which, may explain the blackening of the central strip of the barrow observed here, as also the presence of the human bones. The single burnt bone, whether human or not, may have been an accidental importation. Some adult teeth of *Bos*, from the south side of the barrow, found together, are beautifully coloured by the manganic oxide.

September 26, Saturday.—A piece of the parietal of a human subject, beyond the period of childhood at least, a considerable development of diploë having taken place in it, was found at the bottom, to the south of the middle line, under the slaty, slantingly-arranged rubble, not under the central deposit, at a point about 27 feet from the centre point of the eastward end. On a level with it, as regards the long axis of the barrow, but close to its northern wall, we came upon a stone, 4 feet 9 inches long, 3 feet 2 inches high, placed on its edge, and sunk some way into the natural soil. It had its long axis at right angles to that of the barrow, the wall of which, as afterwards discovered, formed a passage, 4 feet 2 inches wide, leading down to it. Another large stone, 2 feet 10 inches long, 3 feet 3 inches high, also standing on its edge, abutted on the inner end of the first stone, and projected in a south-westerly direction into the barrow; and two other large stones were lying flat near the upright ones. There can be little or no doubt that these stones represent what was once a chamber, such as that found in the long barrow, Swell i.

On this day some few bones of mammals and birds were found in the barrow, west of the line of the cist, and some way above the

level of the natural ground. The mammalian bones belonged to ox, sheep, pig, dog, vole, and rabbit: the larger bones amongst them appeared to be ancient; whilst the smaller, like the bird-bones, some of which belonged to a goose, and some to a fowl, and some to a bird smaller than a pigeon, may have been comparatively recently introduced into the barrow. None were stained with manganese.

September 28, Monday.—A fragment of a tobacco-pipe was found low down, in fact, on the natural soil. On this day the Rev. David Royce came upon the boundary-wall, which had two prolongations inwards, to meet the chamber represented by the large stones mentioned above, and formed thus a passage 4 feet 2 inches wide. The remainder of the day was employed in tracing out the two horns of the east end of the barrow.

September 29, Tuesday.—At a distance of 46 feet from the apex of the re-entering angle, in the centre of the east end, we found the skeleton of a child of about 5 or 6 years of age lying just outside the boundary-wall, on the south side of the barrow. The child had been buried in the contracted position, and had been laid upon the right side, with one hand at its face and the other upon its hip. The teeth have the same purplish blackening, due to manganese, upon them, which has been so often observed in these long-barrow bones from chambers.

On this day we came upon what I believe may have been the ruins of a 'cist,' i.e. of a closed grave, walled in with slabs, and without any passage leading to the exterior such as has been noted in the other barrows, and also in this, and as would have justified us in speaking of it as a 'chamber.' It was 80 feet from the re-entering angle at the eastward end, and being about 5 feet 6 inches by 4 feet, had its long axis at right angles to, and in the middle line of, the barrow. In this cist were found parts of two adult human skeletons, one belonging to a strong man, the other to a woman past the middle period of life; of the skeletons of three children of from 7 or 8 years of age; of one child, of about 2 years of age or less; of a dog's skeleton, lying *in situ*, and close to the bones of the old woman, as also scattered bones of ox and sheep. The bones themselves, closely packed at first, had been much disturbed subsequently, as had also the cist itself. An indication of this was furnished to us by the discovery of the fragments of a

drinking-cup only a couple of inches from the surface of the soil over the barrow. This cup was of a not uncommon pattern, thong-made; and with its paste red outside and black inwards, but was somewhat thicker than 'drinking-cups' are usually. It had probably been interred with a body of a later period than those buried in the cist, and had come into the position in which we found it in consequence of agricultural or other disturbance of the place. To such other disturbance the following appearances seemed to speak. The bones seemed in a few cases to have been left, partially, at least, *in situ;* but in many cases I found a few bones between a couple of slates, the lower of which, in its turn, overlaid a second set of bones. This would appear to be explicable by supposing that, the roof of the cist being removed, its contents were taken out partially, and then thrown in again, with any rubble which came to hand, so as to fill the cist up again.

It is not safe to say what the precise size of the cist had been originally, but it may have been somewhere about 5 feet by 4 feet. The bones contained in it, when examined by me, were disposed as follows:—The first bones come upon were bones of children, some of which had apparently been left *in situ*, and upon the left side, whilst others had as evidently been disturbed. As there were no less than three children with the first permanent molar in use, but with no more, or with only the first incisor of the second set in addition, and consequently all three between 7 and 8 years of age, in this cist, and the western half of it, and, besides them, a child of 2 years, or something less, it is a little difficult to be quite sure how many of so many similar bones had been placed *in situ*. None of all the bones lay upon the natural ground, but all had a flagstone interposed between them and it. On the south side, and, I think, at the south-west angle, part of the lower jaw of a strong adult and the atlas were found near each other. Further east, under one large flagstone, were lying the patella of a strong adult male and some bones of a skull of a child. Of course, these bones must have been disturbed to get thus into company with each other, and with no other bones between two flagstones. In the middle of the cist were found some of the bones of a youngish dog, and amongst them its lower jaw, which show it to have been about the size of an English mastiff; and in the same situation were bones of ox, of

sheep, and of several human subjects, young and old. But the most striking 'find' in the cist was in the north-east corner. There, between two large stones, were found, lying *in situ*, the femora, humeri, ulnae, radii, clavicles, pelvis, rib, and many vertebrae of a woman past the middle period of life. She had been laid on her left side; and between her chest and the north wall of the cist lay the pelvis and leg bones of a young dog, which we may, with some probability—bearing in our recollection the interesting account by an eye-witness, Ahmed Ibn-Fozlau, of the incremation of a Norse chief, translated for us by Holmboe and Anderson[1]—suppose to have been put into the grave to keep his aged mistress company, there and elsewhere. The woman had been laid so that her skull just projected beyond the slab upon which the upper trunk bones were laid; and the skull had just escaped from being smashed, when the top stone fell in, at the cost of being carried off, probably by some mediaeval or later tomb-riflers, and so lost to us. Half the lower jaw was still *in situ*, and has been recovered.

Swell i, Cist 1.—Under this slab, together with the dog and man, were the thigh bones of one of the children, and also femur of sheep. The lower jaw of the old woman was feeblish, as compared with some of the male jaws, but not with all, from these barrows. It had lost no teeth from the half we recovered, during life, though the teeth were very much worn down, and the first molar, notably, down to its fangs; in connexion with both of which there were alveolar abscesses.

The femur, 16 inches long, of the woman, laid in company with the young dog, gives a stature of 4 feet 10 inches. It is considerably flattened from before backwards, in the region of the insertion of the glutaeus maximus, but the insertion of this muscle is at the free edge of the bone. The whole bone, and others with it, under the label, '*Cist in situ*, Swell vi,' gives the idea of their owner having had hard work and poor food, being as they are, slight, but with rough ridges. The other adult bones may have belonged, and probably did belong, to a man beyond the middle period of life, of moderate strength; many of the bones are exostotic, as would

[1] 'Proc. Soc. Ant. Scot.,' May 13, 1872. Compare Nillson, 'Primit. Scandin.,' ed. Lubbock, pp. 140, 150; 'Frilford Graves,' p. 9; 'Archaeologia,' xlii; and Article XXXIV. of this volume.

be expected in the bones of people of such early times, living in a bleak upland country, such as the neighbourhood of Swell.

From the contents of this cist a child's skull has been reconstructed by Mr. Wm. Hine. Aet. circa 7 or 8.

Ext. length	6·5	Least frontal	3·4
Ext. breadth	5·1	Lowest frontal	4·5
Vert. height	5·3	Ceph. ind.	78

This is a high cephalic index, but its height is explained by the skulls having been reconstructed in the interests of brachycephalism, a direction the reverse of what is usual in reconstructed or shrunken skulls; and that this is so, is demonstrable from the fact, that one of the temporals will not fit in between the parietal and frontals.

The interior of the frontals in this skull were richly, and the interior of the parietals more sparingly, covered with vascular osseous upgrowths, just as (skull E, May, 1864, Long Wittenham, Univ. Museum) in many skulls in which the widening of the lower jaw, and with it the easing outwards of the lateral walls of the skull, begins to put an end to the constant pressure which the brain previously kept up upon the skull's interior surface.

Some of the bones from this cist are encrusted with stalagmite, notably those of the old woman, but none of them have any manganic discolouration. One of the humeri of the old woman, the right one, has an olecranic perforation, this peculiarity being in the bones from these barrows, as in some other cases[1] observed in the female more frequently than in the male bones. Many of the bones are beset with exostoses, as in the bones from Swell i.

September 30, Wednesday.—On this day a third receptacle, 'cist,' or 'chamber,' was found to the north of the one just described; it was 4 feet 6 inches wide at its widest part, 3 feet at its narrower, which occupied three-eighths of its entire length of 8 feet, so that it had somewhat of the shape of a bottle. Its long axis, as was the case in both the other similar receptacles, ran at right angles to that of the barrow; its narrower end was within a couple of feet of the north wall of the barrow; its south-east angle was 82 feet from the re-entering angle of the east end. Within this 'cist' or 'chamber' were found parts of no less than ten skeletons, of which

[1] See Broca, 'Mem.' ii. p. 366.

Canon Greenwell, who superintended the examination of it in my enforced absence, speaks as follows: 'It was very difficult to say whether any body was entirely undisturbed, though some had some of the bones in their relative positions. The six bodies' (found on the first day) 'were huddled into so small a space, and the bones were so much broken, that it was impossible to make out the relative position of the bones of the several bodies. I think, however, that some, if not all, of the bodies had been placed in the cist in the flesh, or, at all events, when the ligaments were there .... All the skulls seem to be at the south side of the cist .... These cists are very puzzling .... I do not think they have been tampered with in late times, and the whole appearance suggests an ossuary.'

On October 2 (Friday), Canon Greenwell wrote that 'the cist has had ten bodies in it, and some certainly in position, if all were not. I incline to the ossuary theory more and more.' Details as to the osteology of this rich 'find' will be found further on.

Another 'cist' or 'chamber' was discovered on the same day as this, making up the entire number of receptacles for skeletons, 'chambers,' or 'cists,' to four. In it were found the bones of but a single individual, a young person between the age of twelve and sixteen, the upper epiphysis of the ulna being unanchylosed, whilst all the permanent, except the wisdom teeth, were in use, and an urn of black, coarse ware of quite different character from the one already spoken of as found placed superficially to the second 'cist.' This cist was about 4 feet square; it was close upon the southern wall of the barrow, and about 85 feet from the re-entering angle of its eastern end. The facts of this cist having but a single occupant, and this occupant being a young person, and being accompanied, which was not the case with any other skeleton found in these long barrows, by a food-vessel, are not unimportant. In this barrow, as in the two other long barrows examined by us in this locality, and also in the cases of certain other Gloucestershire long barrows, and in the case of the long Scottish cairn, Camster, in Caithness, no burial had taken place at the east end.

Osteology.—(Swell vi, C. 2).—From the 'chamber' or 'cist' No. 2, examined by Canon Greenwell, and labelled Swell vi, C. 2, we have evidence, through the lower jaws recovered by him, of no less than ten bodies having been interred in it. Of these bodies only one

had belonged to a person below the age of puberty, this one having belonged to a boy or girl of eleven to twelve years of age; six had belonged to persons past the middle period of life, one to a young man with the wisdom tooth just coming into use, a ninth to a man in whom that tooth had come into use, but had had only little wear, and a tenth to a woman in the same condition of dentition. Three of the ten appear to have been women, two of whom were aged, and one probably about thirty years of age; four appear to have been strong men, past middle life, but the sex in one case is doubtful; one of them had been a strong man of about thirty. The lower jaw of the sixth male subject, in which the wisdom teeth are just rising into use, does not enable one to predicate much as to his strength beyond what is implied in assigning it to the male sex. All the lower jaws except three lie evenly from angle to mentum, when laid on a horizontal surface; only one has the foramen mentale further back than it is found to be in modern European specimens. The alveolar portion of the mental region has not the same relative development as is observable in several of the lower jaws from the other long barrows of this district; and this and some other osteological considerations, approximating these skeletons to later, rather than earlier, Celtic types, when coupled with the fact that these bones are much less stained with manganese, and that the grave containing them was most probably not connected by a gallery or passage with the exterior, as is usual in long barrows, incline me to think that this collection of bones may be of less antiquity than the others. In none of these lower jaws had any teeth been lost before death; in only one is there any caries visible, and in one other there is a cavity formed by an alveolar abscess in connexion with a lower front molar worn down to the fangs, and with its pulp-cavities almost entirely obliterated by osteo-dentine.

A considerable number of anteriorly platycnemic tibiae have been removed from this cist; one femur, length 18·2 inches, giving a stature of 5 feet 6 inches, came with such a tibia, length 13·3 inches. It is somewhat flattened superiorly, but is not carinate, though in all probability it belonged to a male subject. One tibia, not platycnemic, has been recovered from this cist; its length is 13·1 inches, giving a stature of 4 feet 9 inches. Three humeri, probably of females, with olecranic perforations, have been re-

covered from this cist, two of which possibly, though not probably, belonged to the same female subject. Of three other adult female humeri from this cist, one shows the commencing of perforation; the other two have no indication of it. Some of the human bones and some of the brute bones found in this cist or chamber present the manganic discolouration. The male and female bones, when compared, show the female bones, especially the clavicles and humeri, to be disproportionately smaller than the male. Some of the bones are beset with exostoses. The instance of an ossified costal, and another of an ossified ensiform cartilage, belong to this series.

Swell vi. (2, 1).—Skull, with part of lower jaw of a strong man in middle period of life, corresponding with the Hohberg type of His and Rütimeyer. 1 and 2 were close together at the south-west corner of the cist, with other bones, all disturbed, but still in some order. N.B.—Parts of two bodies, one a frontal of woman.

Ext. length	7·5	Ceph. ind.	72
Ext. breadth	5·3	Glabello-inial length	7·3
Vert. height (approx.)	5·9	Circumference (approx.)	21

Ant. post. index, 97 out of 190.

There is considerable obliteration of sutures internally. The teeth are much and horizontally worn; some appear to have been lost during life, but no wisdom teeth were developed. The mastoids and supraciliary ridges are large, and the muscular lines for the temporal insertions pronounced. Frontal and parieto-occipital regions describe an even curve. The highest point in the vertical arc is a little posterior to the coronal suture. The sides of the occipital pentagon incline outwards a very little from the region of the parietal tubera, which in this skull are very faintly indicated, as in the Hohberg type of His and Rütimeyer, which it resembles also in its well-marked vertical carination. The mental prominence is not very great, but is markedly triangular when viewed from the front.

Under this label came the frontal and other bones of a woman.

Swell vi. (2, 2).—Skull, with part of lower jaw of woman past middle period of life. This skull was in the south-west corner of the cist, close together with Swell vi. 2, 1. Other bones were together with the skull; some finger-bones were at the head of 2; and in front of the neck a bead of Kimmeridge shale; but the

bones were so much intermixed, it was difficult to say with which body it was associated.

Circumference	20·3	Vert. height	5·7
Ext. length	7·2	Ceph. ind.	77
Ext. breadth	5·6	Glabello-inial length . . .	6·8

Ant. post. index, 98 out of 183.

This skull, though large, and notably possessed of large mastoids, is, nevertheless, all but unquestionably a female skull, as shown by the verticality of its forehead, the absence of large supraciliary ridges, the prominence of its parietal tubera, and the smallness of its teeth.

The highest point in the vertical antero-posterior arc lies a little behind the coronal suture. The parieto-occipital, like the frontal region, has the vertical dip characteristic of the female sex. The difference—four-tenths—between the glabello-postremal and the glabello-inial diameters depends to a considerable extent upon the thickness of the superior occipital squama. Viewed in the vertical aspect, the skull presents a smoothly rounded-off outline, which has its point of maximum width in the meridian of the mastoids, and tapers somewhat rapidly forwards, and more gradually backwards, from that level, 123 parts out of 183 being anterior to it, as in Swell vii. 1, 1. The tubera parietalia are prominent, and the lateral walls converge downwards from them, and, as in female skulls, there is no vertical carination.

This skull has many of the characteristics of the 'Sion typus,' in contradistinction to those of the Hohberg; but they are referable, I think, to the difference of sex mostly, e.g. the forward position of the point of greatest width, the smoothly rounded outlines, and the absence of a vertical carina.

An upper incisor and a canine are the only teeth lost during life.

Swell vi. (2, 3).—'Just south of 1 and 2 came another body, 3, with fingers at head, but whether disturbed or not I cannot say' (note of Canon Greenwell). To this may, perhaps, be referred an occipital and part of a parietal, labelled Swell vi. 2, 4. This occipital resembles the one just described, and also that belonging to Swell vi. 2, 5, in its great thickness.

Swell vi. (2, 4).—Immediately east of 1 and 2, another body, 4, on right side, head to E.S.E. At knees of 4, another body, 5.

Portion of calvaria of, probably, woman in or past middle period

of life, long, flat, and low, from, probably, very much such a skull as Swell vi. 2, 5; so that it is possible enough that these two skulls may have belonged to a mother and a daughter. The adult female humeri imperforated.

Under this label came also the bones of a strong male subject, many of which were exostotic.

Swell vi. (2, 5).—This calvaria probably belonged to a woman in the middle period of life. All the bones are of considerable thickness, but the skull does not bear the appearance of old age in other respects. Under it, however, are the bones of a much older and stronger subject (sex?). To it probably belongs an upper jaw which had lost no teeth during life, though some are much worn, and in which no wisdom teeth have been developed.

Ext. length	7·4	Ceph. index	7·2
Ext. breadth	5·3	Glabello-inial	6·8

There is a furrow developed along the posterior two-fifths of the sagittal suture; and in this respect, as in the more significant one of its elongato-oval vertical contour, and its fairly rounded-out outlines, as also in its relative lowness, so far as can be approximatively made out, this skull resembles the dolichocephalic form so common at Frilford, and in other Romano-British cemeteries. I have seen similar skulls in Dr. Thurnam's collection from Tilshead, West Kennet, and Nympsfield, but they are not common in early British cemeteries.

A bone of a pig came with these bones, as also parts of another and older human subject, distinct from either, under label vi. 2, 4.

At knees of 4, another body, 5, apparently on right side, head to E.S.E., hands to face, only one piece of lower jaw.

Swell vi. (2, 6):—

Ext. length	7·7	Glabello-inial length	7
Ext. breadth (approx.)	5·6	Frontal arc	5·7
Vert. height	6·1	Parietal arc	6·1
Ceph. index (approx.)	74	Occipital arc	4·9

Calvaria with upper and lower jaws of man in middle period of life. The sagittal suture is entirely obliterated internally. The teeth, some of which had been lost during life, though none are carious, are a good deal worn. The mentum is characteristically triangular, but not prominent. The foramen mentale is in the

line of interval between praemolar 2 and molar 1. The forehead is vertical up to the level of the frontal eminences; it then passes with an even curve backwards. The highest point of the vertical arc is an inch behind the coronal suture, the posterior halves of the parietals form an equable slope with superior occipital squama. The frontal sinuses are large.

It is a good representative of the Hohberg or Cumbecephalic type of skull.

With this skeleton were the humerus of a mole and a tooth of a fox.

Note by Canon Greenwell.—'Just south of 5, another head, 6, whether disturbed or not cannot say. The whole looks as if bodies had been partly divested of flesh.'

Swell vi. (2, 7).—Under this label came two lower jaws, one certainly of a man of some considerable strength, and about thirty years of age; the other may have belonged to either a man or a woman, but in either case to an aged individual. Neither jaw had lost any teeth before death, though there is much horizontal wear of them in the older jaw.

Note by Canon Greenwell.—'Close to the west end of cist, at north side, a skull, 7, on the right side, laid on hip bones and sacrum of another body. There is a connection with one femur at least. . . . . The body, 7, must have been on right side. Under 7, and pelvic bones, a very rotten skull, 8.'

Swell vi. (2, 8).—Boy or girl of about eleven or twelve years of age.

Swell vi. (2, 9).—Skull of an aged person, probably a female; but under this label there are certainly parts of two bodies—one a strong man's, the other a woman's. The skull and the lower jaw I incline to think a woman's. With the skull came, in one paper, two vertebrae, two of the upper dorsal, with the following note: 'These belong to 9, and were placed 1, 2, across the line of the others.'

In another, seven of the lower dorsal came also in a paper by themselves. On the paper a note was written to the effect that they had all been found in connection.

The dislocation of backbone of 9 was probably caused by the lower part, which was on a large stone, not having gone down while the upper part settled.

The femur is flattened in region of glut. max., and gives a stature of 5 ft. 6 in. The tibia is flattened; but did these bones belong to the skull?

Ext. length	7·1	Ceph. index (approx.)	75
Ext. breadth	5·3	Femur	18·2
Vert. height	5·5	Tibia	13·5

Viewed from above, this skull has an evenly ovate contour, tapering only very gradually either backwards or forwards. The point of maximum width is in the meridian of the mastoids, which are large for a female skull. The forehead is vertical up to the level of the tubera, and the parieto-occipital region is also a little more vertical than is usual in skulls of this elongated type. The parietal tubera are less well marked than is usual in female skulls. The supraciliary ridges, however, are characteristically female, as are also the low height index and the lower jaw, the teeth in which are very much worn, and, though an alveolar abscess was developed under the anterior molar, had not been diminished in number by more than one or two during a very long life.

Note by Canon Greenwell.—'Just north of 7 and 8, a body, 9, on left side, head to south, apparently in position; hips are 7 inches higher than the head. Just north of hips of 9, a skull, 10, close to surface and much disturbed, No. 9 being the highest body, as regards the hips. The fact of its being undisturbed shows that any dislocation or breakage is not due to modern agencies.'

Swell vii.—The third long barrow examined at Netherswell in Sept. 1874, is situated on a hill to the N.W. of Netherswell Church, in the district known as Upper Swell, upon the estate of Alfred Sartoris, Esq., by whose kindness Canon Greenwell was allowed to explore it. It is the largest of the three barrows examined here, and resembles the second very closely in its contour, and both that and the first in the materials—oolitic flags and rubble—of which it is made up. Its extreme length is 173 feet. Its length from its westward end to the central concavity of its horns 156 feet; its extreme width, which lay about 20 feet west of the apices of the horns, is 57 feet; its least width, which is, as usual, at the west end, is 32 feet. The height of the mound is from 6 to 8½ feet above the natural surface; it is surrounded by a wall, which was 5 feet high at the east end, where it defined the outlines of the horns, and about 4 feet high round the sides and west end, being in thick-

ness about 1 foot 6 inches. Its west end was quadrangular. Its long axis ran very nearly due east and west, as was shown in a ground-plan and sections, which, like a plan and section of 'Swell vi.,' was taken by Sir H. Dryden, Bart.

The point of special interest in this barrow was the presence in it, at 24 feet from its west end, of a chamber 7 feet by 4 in size, which had long ago, though within the memory of man, been rifled, but which still contained, in September, 1874, evidence of having furnished lodgment to no less than nine human bodies. To this chamber a passage led, the limit between chamber and passage being marked by the presence of a sort of doorway, across which a large flagstone crossed, at a distance of 1 foot 3 inches from the ground, and helped to support the roof. The floor of the passage was flagged, whilst that of the chamber was not, and just outside the doorway opening into the 'chamber' lay parts of two more or less disturbed skeletons, one of a woman, one of a child, overlaid by an almost or entirely undisturbed male skeleton.

As regards this arrangement of the stones of which the barrow was made up, it is well to state that between the north and south walls the largest stones were found in the middle line, and were thus often placed upright with the more outwardly placed stones sloping towards them, and resting upon them for some distance, and then assuming a more horizontal arrangement. The first three feet from the ground were occupied by larger stones; the upper three of the entire number of six, the average height of the barrow, were occupied by smaller and less regularly placed stones. It was here, owing to the size of the barrow, and notably its height, that we observed that the workmen, in removing the stones in the various exploratory incisions, came constantly to arrange the stones which they displaced, in horizontal layers, for the sake of security from down-falls. Thus an appearance just like that of the transverse 'walling,' often observed in the undisturbed parts of the barrow, was frequently produced, and it is obvious that the two similar arrangements, however different in date, must, in all likelihood, have been due to the same cause, viz. the consideration by the labourers concerned of their own convenience.

The concavity of the horns at the east end was filled up for a space of 2 feet in depth with fine, small stones, outside of which again came larger stones, all evidently arranged intentionally, and

in no way owing their disposition to the disintegration of the tumulus into talus. The horned east end, therefore, which, to us, when we had removed these masses of stones, presented a magnificent and striking appearance, was not presented to the eyes of the early Britons, who erected it, nor, till 1874, had it been presented to those of any one else.

The almost perfect state in which one skeleton found in the passage was recovered enhances the regret with which we have to think of the rifling of the 'chamber,' and the destruction, for craniological purposes, of the nine, or possibly more, bodies it contained. This skeleton was much contracted, lying on its left side, with the head at south-west by south, with the right hand up to the face, and the left at the elbow of the right arm. The two skeletons which lay beneath this one had been disturbed, probably, when its owner came to be buried. One of the two disturbed skeletons had belonged to a child about two or three years of age, and it lay under the lower part of the man's skeleton, having all its upper part in position, with its head to the north. Close to the child's head was the arm-bone of a woman from 18 to 20 years of age, of whose skeleton the lower vertebrae and pelvic bones were *in situ*, whilst the rest had been disturbed, and the skull was missing. The femur was recovered, however, and being 15·9 inches in length, gives a stature of 4 feet 10 inches; one disproportionately small, as compared with that of the male, which was 5 feet 5 inches.

No record has been preserved, or, at least, has been recovered by us, as to how the nine bodies, or more, which the chamber contained had been packed away in its area of 7 feet by 4. Some further interest is given to this barrow by the fact that some secondary Saxon burials were discovered in it in the November of 1874. Two of the three bodies discovered upon this occasion had been disturbed; one was in the extended position, and still *in situ* from patellae to lower jaw, inclusive, but had suffered some displacement, owing, probably, to the exceeding shallowness (9 inches) of the grave in which it lay. With this skeleton were two buckles, one on each shoulder, a knife on the pelvis, an amber bead near the sternum, and a piece of red pottery (pseudo-Samian) at the feet. The bones show the skeleton to have been a woman's, of about thirty years of age, and the mode of burial shows the sex and nationality to be as above stated. The head was at the south, the hands upon the pelvis,

Lying upon the chest of this skeleton were a number of fragments of another adult skull, and to the right of its knees were the femur, tibia, and humerus of a strong old man; and about 6 inches from the right humerus of the female skeleton were parts of the skull of a baby, some fragments of which were also found over the female skeleton, and between its legs. Probably, or all but certainly, the two skeletons of the baby and of the old man had been disturbed and replaced when the woman was buried. Some bones of ox and of sheep, the latter differing much in size, were found in this grave. The grave was about 18 feet from the re-entering angle of the horned east end, and probably to it may belong a 'spindle whorl' of stone, found October 5th, by Canon Greenwell, 3 feet 9 inches from surface, when making a large excavation close to the spot where, a little more than a month later, viz. November 7th, the female Anglo-Saxon belonging, as she and her tribe might have phrased it, to 'the spindle side,' was exhumed.

Traces of another secondary burial, which, though earlier than that of these Saxons, was later than the burials of the occupiers of the chambers, and the passage leading to it, may be supposed to be furnished to us by the discovery of some fragments of a very beautifully ornamented drinking-cup on the top of the barrow, very near the apex of the south horn at the east end.

At the opposite end of the barrow, on its south side, and about 6 feet from the south end of the chamber containing the fragments of nine bodies, a piece of a red deer's antler, partly cut, was found among the small stones and clay, which at that point formed the lower part of the mound. Bones and teeth of sheep, ox, and calf, as also a piece of burnt bone, probably human, were found elsewhere, some 3 feet deep, some at the very bottom, in the barrow; and bones of sheep, ox, and pig were found in the chamber, together with the human bones.

Osteology and Craniography of human remains from Swell vii.— Under the label 'Swell vii. gen.,' signifying bones from the interior of the chamber generally, and under the label 'Swell vii. 1,' we have bones proving the presence in the chamber, and in the passage leading down to it, of no less than twelve bodies, eleven being bodies of adults, and one the body of a child. Two of the adults from this barrow appear to have been about twenty years of age, one about thirty, and the rest to have been in middle life or

beyond it. The long exposure to indiscriminate plundering which this chamber had undergone, accounts for the fragmentary condition to which most of the bones still left in it had been reduced; had a freer entrance been made into it, however, even what has been saved to us would long ago have been irrevocably scattered. Some of the long bones, however, have escaped, so as to allow us to measure them, and draw from these measurements conclusions very similar to those which the remains found in the two other long barrows here described have enabled us to draw. Some of the femora and some of the humeri, for example, must have belonged to men of very great muscular power, whilst some of the other long bones must have belonged to females of eminently small size and strength. Two radii, for example, measuring, one of them $8\frac{5}{10}$ in., and the other $7\frac{6}{10}$ in., and being exceedingly slender, though obviously adult, enable us to say that their owners must have been ill-nourished women, such as are the wives of savages, of a stature, in the one case, of 4 ft. 9 in., and in the other of 4 ft. 7 in. The femora of the male and female skeletons found lying at the entrance to the chamber being 18·1 in. and 15·9 in. in length, respectively, give us for their owners the disproportionate statures of 5 ft. 6 in. and 4 ft. 9 in., respectively. A similar disparity exists between the clavicles; an observation made, like several others relating to this barrow, also in the cases of the other barrows examined here, and in the case of the human remains from the caves[1] of Gibraltar examined by Professor Busk. Six lower jaws were recovered from this chamber, all but one of which must have belonged to strong adult men. The body of the bone lies, in nearly every case, evenly, on a horizontal surface, and forms a right angle, or something nearly approaching a right angle, with its ramus. The mental foramen lies far back in several instances, and the alveolar portion of the mental region is largely developed. In every case but one the full number of teeth was retained up to the time of death, even though the teeth are very much worn in most cases, and in some even down to close upon the fangs. There was only one case of caries. Mr. Mummery[2] has made similar observations to these in relation to Dr. Thurnam's Wiltshire skulls, remarking, in addition[3], that a much less favourable state of things prevailed

[1] See 'Transactions Prehistoric Congress,' Third Session, p. 54.
[2] 'Transact. Odont. Society,' Nov. 1869, p. 13. [3] p. 15, l.c.

as to the dentition of the dolichocephali from the Yorkshire Wolds.

There were two humeri from this barrow, both evidently female, and possibly from the same individual, with olecranic perforations. Of the opposite condition of hyperostosis we have an example in the supraciliary ridges of one fragmentary and one nearly perfect frontal bone, the ridges not being underlaid by sinuses, but made up of cancellous bone. There were found here also one specimen of an ossified thyroid cartilage, and one of anchylosis of the dorsal vertebrae.

Many of the bones are encrusted with stalagmite; and a considerable number, both of the human bones and of the bones of sheep, ox, and pig which were found in the chamber, were discoloured by the manganic oxide, a circumstance which renders probable at once the contemporaneity and the antiquity of both.

Description of skull belonging to male skeleton found in passage leading into chamber.—Swell vii.—The bones of this skeleton show their owner to have been a man of about thirty years of age, traces of the suture between the first and second sacral vertebrae being still to be recognised in the middle line; to have been of average muscular strength, and of a stature of about 5 feet 5 inches. With his bones came also the jaw of a young pig, just as was the case with the bones from the chamber in Swell i.; as also some bones of a sheep or goat.

Cranial Measurements.

Ext. length	7·4	Cephalic index	·76
Ext. breadth	5·6	Antero-posterior index	94 : 189
Vert. height	5·65	Distance from auditory foramen to fronto-nasal suture	4·3
Least frontal width	3·8		
Frontal arc	5·2	Distance from auditory foramen to nasal spine	4·2
Parietal arc	4·8		
Occipital arc	4·7	Distance from auditory foramen to alveolar edge	4·4
Circumference (approx.)	21		
Glabello-inial length	7·3		
Height of orbit	1·35	Width	1·6
Interangular diameter of lower jaw			4·1
Depth of symphysis			1·4
Width of ramus			1·4

This skull has the typical dolichocephalic contour when viewed in the norma lateralis, though by mere measurement it is less dolichocephalic than skulls from similar barrows usually are. The highest point in its evenly curving antero-posterior arc is at the coronal suture. Its most striking characteristic is the prominence of its

parietal tubera, which mark the point of its maximum breadth. From this level the skull is wall-sided downwards, and to complete the character of an 'ill-filled[1]' skull, it slopes upwards from the same level to the sagittal line. It further shows a flattening externally and a convexity internally over the posterior inferior angles of both parietals, an appearance corresponding to the presence of certain irregular fissures in the brain, immediately posterior to the middle temporo-sphenoidal convolutions, and indicative of a lowly developed brain. The mastoid, the glabellar, and the supraciliary ridges are largely developed, and the latter are not underlaid by any frontal sinuses.

Viewed in the norma verticalis, the skull is pear-shaped, tapering rapidly from the level of the parietal tubera, both forwards and backwards. The parietal tubera are situated well forward, occupying a point which is at the 105th division out of 189 of the line of the whole length of the skull from the forehead backwards. The occiput is blunted posteriorly; and in these two latter particulars the skull resembles the 'Sion types' of His and Rütimeyer. It is phaenozygous, as the 'Sion types' are sometimes, though not always. The three principal sutures are complexly denticulated; the sagittal is nearly obliterated in the fifth of its length, corresponding to the entirely obliterated foramina emissaria. Internally the obliteration of the sutures has progressed much further than it has externally, and the walls of the skull are thick. In the norma occipitalis the pentagonal outline is very well marked, the lateral walls inclining inwards from the level of the tubera, and the roof falling away from a well-marked sagittal elevation. The conceptacula cerebelli have the horizontal position so characteristic of dolichocephalic skulls. The palate is deep and elliptical. The wisdom teeth are little worn; the teeth anterior to them, on the contrary, very much. The lower jaw lies evenly on a horizontal surface; the alveolar portion of the mentum is largely developed; the inferiorly placed, triangularly contoured portion of the chin is less in proportion than is usual in European skulls.

[1] For use and application of this epithet, see Cleland, 'Phil. Trans.,' 1869.

XIX.

NOTE ON THE ANIMAL REMAINS FOUND AT CISSBURY[1].

THE most surprising, though by no means the most important result of the examination of the animal remains found in the excavations at Cissbury was the demonstration of the existence amongst them of the bones of the wild ox, *Bos primigenius*, and the wild boar, *Sus scrofa v. ferus*. It is true that we have abundant evidence from the consilient utterances of poets, historians, and naturalists, from the names of men and places, and from other quarters also[2], for showing that these wild animals persisted into quite recent historical times. Still, for all that, it has been at least rare to find their bones in any prehistoric excavation. I had never been so fortunate as to meet with any such remains so placed till my experiences at Cissbury. It had never seemed difficult to me to account for this absence, the presence of the remains of domestic animals sufficiently explaining it on the principle of 'least action,' a principle which commends itself as much to savage as to sage. Hence, when I was told that in the pits excavated at Cissbury by the late Mr. Tyndall, of Brighton, the bones of *Bos primigenius* had been found in considerable quantities, as also those of *Sus scrofa v. ferus*, I felt and expressed a great anxiety to see them. This wish was gratified and my scepticism removed by the kindness of my friend Mr. Ballard, of Broadwater, who presented me with the bones now to be described as having come from

[1] [In November 1875 Colonel A. Lane Fox, now Major General Pitt-Rivers, communicated to the Anthropological Institute a Report of the Exploration Committee On the Excavations in Cissbury Camp, near Worthing, Sussex, which disclosed a great factory for flint weapons ('Journ. Anth. Inst.' v. 1876). The above account of the animal remains discovered in the course of these excavations was given by Professor Rolleston and published in the Journal of the Anthropological Institute, vol. vi. p. 20, 1877.—EDITOR.]

[2] See Dr. J. A. Smith, 'Proc. Soc. Ant. Scot.,' 1871-72, ix. p. 667.

Mr. Tyndall's pit (see p. 364 of 'Journal of the Anthropological Institute,' Jan. 1876, fig. 1, *k*, Plate xiv).

I. *Remains from Mr. Tyndall's Pit.*

1. Distal end of left humerus of *Bos primigenius*, with some marks of burning upon it. This fragment consists of the condyles and so much of the shaft as to bring it up to a length of 7·7 inches. Its large proportions are the first point which strikes the eye, bringing to mind Caesar's words as to the urus of his day, 'magnitudine paullo infra elephantos.' Its brightish, glazed appearance comes secondly under notice; and, thirdly, the sharp definition of its angles, and processes, and articular surfaces. Looking at it a little more closely, we see a beautiful polygonal reticulation standing out upon the bone, over the surface which gave origin to the lowest fibres of the brachialis anticus. Just such an appearance is presented by the neural arch of the third cervical vertebra of *Bos primigenius* figured by Rütimeyer, Tab. iii. fig. 3 of his 'Fauna der Pfahlbauten,' and commented upon by him at pp. 15 and 72 of the same work. They are to be seen, but only in a rudimentary form, in the humerus of a fine Chillingham bull lately presented to the Oxford University Museum by the Earl of Tankerville, immediately above what, in man, would be called the coronoid fossa. The thickness of the cylindrical wall of the humerus is 20 millimeters. The extreme width at the condyles is 120 millimeters, as against 83 in the Chillingham bull. The circumference taken at a tangent to the apex of the facet for the head of the radius, is in the Cissbury bull 200 millimeters, as against 139 millimeters in the Chillingham bull.

2. The measurements of an ungual phalanx from a fore-foot of the Cissbury bull illustrate the axiom *ex pede Herculem*, and will show any one who will construct a couple of triangles with the subjoined two sets of dimensions how greatly the ancient wild bull exceeded in size what Rütimeyer holds to be its modern representative:—

Fore ungual phalanx.	*Cissbury Bos.*	*Chillingham Bos.*
	Mill.	Mill.
Extreme length along inferior edge	90	72
Extreme length along upper edge	70	53
Height	64	48

3. Fragment of tibia, proximal end, *Bos primigenius*. Thickness of cylinder of bone, exclusive of spongy diploë, 15 millimeters.

4. Fragment of femur, proximal end, *Bos primigenius*. Thickness as above, 14 millimeters.

5. Two fragments of frontal bone of *Bos primigenius*, with strikingly glistening and dense-textured walls to frontal sinuses.

6. Fragment of rib of *Bos primigenius*. Its extreme depth is 53 millimeters, as against 45 millimeters in the Chillingham bull.

7. Upper molar teeth, *Bos primigenius*.

8. Part of lower jaw of wild boar, *Sus scrofa v. ferus*, with second and third molars *in situ*, and the last just come into use. The bright glazed appearance characteristic of the wild variety of *Sus scrofa* is well marked on the outer, but eminently well on the inner, surfaces of the wall of the jaw.

Very many more bones than these were procured by Mr. Tyndall from his pit at Cissbury. His lamented death has, I believe, caused many of them to be irrecoverably lost. Those described are all that I have access to.

The presence of these wild animals in Mr. Tyndall's pit may be explained by the usually mistranslated[1] words of Julius Caesar,

[1] For example, Canon Tristram, in his 'Natural History of the Bible,' 1867, p. 148, translates them thus: 'The hunters are most careful to kill those which they take in pitfalls;' and the Rev. J. G. Wood, in his 'Bible Animals,' p. 128, renders them thus: 'These, when trapped in pitfalls, the hunters diligently kill.' Very little care or diligence would have been required for killing, though a very great deal would have been required for keeping alive, a wild ox which fell into such a pit as Mr. Tyndall's, thirty-nine feet deep. If the writers just quoted had recollected that in times previous to the invention of pumps it was a very common thing for 'an ox or an ass to fall into a pit,' not *studiose*, but *casu aut forte fortuná*, they would have seen that the word *studiose* should be taken with '*captos*.' So common, indeed, in those times were such accidents, that Maimonides has written at great length about them in his treatise 'De Damnis,' a well-known work of great authority. Or if they had read a few lines more of Caesar's in the same connexion, they would have come upon the words 'Haec (cornua) studiose conquisita,' which might have suggested a truer rendering. It is curious to note that Cuvier, 'Oss. Foss.,' iv. p. 113, 2nd ed., omits the words in question altogether; and Gervais, 'Zoologie et Paléontologie Française,' p. 131, 1859, who would have done well had he followed Cuvier in some other matters, follows him in this implicitly. The really 'learned' member for the City of Oxford, Sir Wm. Harcourt, drew my attention to the splendidly illustrated edition of the 'Commentaries,' published by Jacob Tonson, in 1712. On referring to it I found M. Gervais' error anticipated, Caesar's description of *Bos urus* being illustrated by a magnificent, however misplaced, picture of a—Bison. Nor do I entirely agree with the translation given by Mr. Edward Lee (p. 13 of his charming little book, 'Excavations at the Kesserloch,' by Conrad Merk; translated by John

'Comm. de Bello Gallico,' vi. 28, when writing of the capture and slaughter of *Bos primigenius* by the Germans: 'Hos studiose foveis captos interficiunt. Hoc se labore durant adolescentes,' &c. These five latter words appear to me to mean that a good deal of trouble must have been taken and a good deal of risk run in getting the wild cattle to the pitfalls; merely butchering the animals after they had tumbled in would not harden a young man, at least in the sense in which Julius, one of the least cruel of a cruel people in a cruel age, would have wished to see a young man hardened. Hurdles of gorse probably were arranged on the principle of the wicker-hoops in a decoy, and it is easy to see how, by such a plan, eked out, perhaps, by the firing of heaps of the same useful material, a wild bull or a herd might be driven over a pitfall.

II. *Remains from 'Large Pit.'*

I come, in the second place, to the consideration of the animal remains found in the 'large pit' marked *m* in fig. 1, Plate xiv., given in sections and plan in Plate xvii. of Colonel Lane Fox's paper in the number of the 'Journal of the Anthropological Institute' for January, 1876, vol. v. No. 3, and described by him pp. 379–382, l. c. The entire number of bones from the large pit which I have before me for identification amounts, exclusively of a number of deer-horn implements described by Colonel Lane Fox, and exclusively of five molars of horse found lying superficially, to about thirty. Of this number, ten are fragments of bones of the domestic ox, *Bos longifrons*. Ten upper jaw molars from the same animal are likewise counted in it, and enable us to say that at least two

Edward Lee. Longmans, 1876): 'They (the natives) catch them in pitfalls made with great care, and then kill them.' That great care was used in making and covering over the pitfalls I do not dispute, but great care, I am sure, must also have been used to secure that the animals ran over them. Julius says neither more nor less than that the uri are taken, with great trouble, by means of pitfalls and killed; and that the great trouble includes the riskful process of driving the herd, as well as the very safe one of digging the pit, the context seems to me to indicate. Hence I demur also to the free rendering given by Dr. J. A. Smith in the 'Proceedings of the Society of Antiquaries of Scotland,' ix. p. 596: 'The man who killed the greatest number of them, *even by the pitfall*, brings the horns as an evidence of his prowess, and is highly applauded by his countrymen,'—though this interpretation, like Mr. Lee's, shows that the author had striven to realise to himself the circumstances hinted at rather than described by Julius, and did give the greatest man of all antiquity, if not of all time, credit for writing something like common sense.

individuals of this variety of *Bos* are represented in this collection; five are bones of the domestic pig, *Sus scrofa v. domest.*, and give proof of the presence of two individuals; one bone only testifies to the presence of the red deer, *Cervus elaphus*, so abundantly represented by its horns; the roe, *Cervus capreolus*, is represented by a piece of frontal bone carrying a nearly perfect horn, and also by a seventh cervical vertebra. A large part of the skull of a goat, *Capra hircus*, is labelled 'Red seam, large pit, 9 feet 6 inches beneath surface.'

The first remark to be made about this collection of bones is that the smallness of their number is an argument in favour of the pit having been filled up very soon after it was first excavated. To this conclusion other considerations have been shown (see 'Journal of Institute,' l. c. pp. 381 and 386) to point. Eight bones of the thirty bear labels which show that they were found below the level of the 'red seam,' i. e. below the level to which the first 'filling up' reached. These eight bones belong to the roe, the domestic ox, and the goat respectively. There is one bone, a nasal, which might have belonged to *Bos primigenius*, but it would not be safe to speak positively as to thus identifying it. And dismissing it from consideration, we have from this 'large pit' three domestic animals, the cow, the goat, and the pig, accompanied by two wild ones, the stag and the roe. The absence from this particular collection, and, indeed, from the entire Cissbury series which has come into my hands, of the dog, would be remarkable if we did not bear in mind the short time for which these pits were ordinarily left open, and then consider at what widely distant intervals in a modern household such an event as the death of a dog takes place. The remains of the dog are found, though very sparingly, in the earliest human habitations, ancient, like modern, savages having domesticated it before they domesticated the pig; and we have Professor Boyd Dawkins' authority (see 'Journal of Institute,' l. c., p. 390) for saying that the dog, as well as the goat and the *Bos longifrons*, were found by Mr. Tyndall in his pit, already dealt with. The fauna of the 'large pit' may, perhaps, therefore be considered to belong to a somewhat later date than that of Mr. Tyndall's pit, as it comprises the domestic pig, which was not reported to have been found amongst that collection, and is entirely without any bones of the wild boar, and probably also without any

of *Bos primigenius*, which was so abundantly represented there. From the fauna of the 'skeleton pit' (see page 376, l. c., Journal), to be hereinafter described, that of the 'large pit' does not differ in any particulars which would justify us in thinking that the two pits belonged to different epochs; and here again the evidence from the animal remains coincides with that from other lines of investigation.

List of bones from 'Large Pit.'

Bos longifrons.—Part of left upper jaw with the two last molars *in situ*, labelled 'From large pit.' Part of palate, labelled 'From 23 feet below, beneath upper margin.' One lower jaw and nine upper jaw molars. End of radius 3 feet below the surface. Glenoid of scapula 6 feet. End of radius 20 feet beneath upper margin. Fragment of scapula 35 feet below upper margin. Part of right upper jaw of a calf with one tooth of large size in alveolus not through gum, and a second small tooth still in substance of jaw.

Bos primigenius.—A single nasal bone.

Sus scrofa v. domesticus.—Os calcis 'from red seam.' Left ulna labelled 'large pit.' Right ulna, similarly labelled, and probably from same individual. Femur of young individual. Fragment of lower jaw of an older individual.

Cervus capreolus.—Horn with part of frontal, 33 feet beneath upper margin; seventh cervical vertebra.

Cervus elaphus.—Part of radius of young specimen.

Capra hircus.—A considerable part of the skull with both horns, labelled 'Red seam,' 9 feet 6 inches below the surface.

These bones afford proof of the presence in this pit of two individuals of *Bos longifrons* and *Sus scrofa v. dom.*, one only of *Cervus capreolus*, *Capra hircus*, and *Cervus elaphus*, though the *horns* speak to the presence of many more.

A number of molar teeth of the horse, *Equus caballus*, have also come into my hands, labelled 'Large pit, superficial,' and the addition of this last word is significant when we add that it is applicable to all the remains of the horse found at Cissbury, and that considering the large size and durability of the bones of this animal we have some justification for holding that if the first excavators of the shafts and galleries had domesticated it we should have come upon some osteological evidence of their success. As

none such is forthcoming, we have a fresh point of agreement between the fauna of Cissbury and that of other excavations of the stone period.

The bones of a young badger, *Meles taxus*, as also of a young fox, *Canis vulpes*, have been put into my hands from the Cissbury excavations; their exact locality is not specified; and it is possible that they may be of comparatively modern date. It should be noted that neither the red-deer nor the roe antlers are always merely *shed* horns, portions of the frontal bone being in some cases left in connexion with them.

I come now to the fauna of the 'skeleton shaft,' the shaft in which a human skeleton was found, as described by Colonel Lane Fox, p. 375, l. c., Journal. The animal remains found in this shaft not only bear directly upon the mode of life and degree of culture which the excavators of this shaft and its fellows enjoyed, but they also very irrefragably prove that these shafts had been filled up before the second race of stone-using men dug their ditch and threw up their ramparts. It will be convenient, firstly, to give an account of the vertebrate animal remains, as has been already done with those found in Mr. Tyndall's and in the 'large pit'; secondly, to show how the shells of the mollusca, found in great abundance in the shaft, bear, as the shells of mollusca so ordinarily do, upon the age of the various strata in which they are found; and, thirdly, to describe the human skeleton found with those remains, attempting whilst doing this to frame some reasonable hypothesis as to the way in which this representative of the horde of Cissbury flint-miners came by her death and burial.

III. *Mammalian remains from Skeleton Pit.*

The skeleton shaft was a smaller but not a shallower pit than most of those examined by us at Cissbury; its diameter was 4 feet 6 inches, whilst its depth from the surface, before the ditch was made, was 14 feet. In this pit were found more than 1000 separate bones and fragments of bones of artiodactyle mammals, mixed up with an almost entirely complete human skeleton, but contrasting with it, firstly, in being usually fragmentary themselves, and, secondly, in making up by no means the full tale of the bones of the skeletons which they represented. The immense majority, about 600 out of 1000, of the lower animal bones in this pit was

made up by small fragments of the bones of the domestic pig, *Sus scrofa v. domesticus*; and all the larger and longer bones were imperfect from old breakages. The pig-bones give evidence of the presence in this pit of at least six individuals, two of which had been very young, and none of which had attained the age of eighteen months, as in none of them had the last true molar come into use. It has only been by the fragments of the lower jaws that I have been able to establish the existence of bones from as many as six pigs in this shaft; no one set of bones of any other denomination give evidence of more than four individuals of this species having been present. The very large number of pig-bones, and the small size of some of the fragments of the lower jaws, may serve as something of an excuse for my having given four (see p. 376, 'Journal of Institute,' Jan. 1876, vol. i. No. 3) as the number of individual pigs represented in this collection from the 'skeleton shaft.' It is of some consequence, as regards the view we have to form as to the way in which the bones of the lower animals came to be mixed up with those of the human skeleton, to have a precise enumeration of the number of those animals, and as nearly an exact enumeration of the number of bones by which each one was represented as may be possible. If all or a large part of the bones of all the skeletons had been found in the pit with the human skeleton, it might have seemed probable that the animals in question had been sacrificed, as in the familiar instance of the funeral of Patroclus, in honour of, and at the time of the interment of, the human body. But as it was found that the bones, whilst giving evidence of the presence in the pit of six or seven animals, fell far short of containing the proper complement of bones for an equivalent number of skeletons, some skeletons being represented by very few bones, it was plain that the human and the brute skeletons had come together into one and the same receptacle after experiencing, previously to their common interment, entirely different modes of handling. There is no reason to suspect the Cissbury flint-miners of cannibalism, but the animals we may reasonably suppose to have been eaten, most of the marrow-containing bones having been splintered, and the immense majority of the other bones presenting old breakages.

The fact, which the subjoined table of the bones of the domestic pig will show, that no less than four more or less perfect sets of

vertebrae have been recovered from this pit may seem at first hardly in keeping with the view just stated. But the Homeric epithet for the chine, as eaten at feasts ('Iliad,' vii. 321), curiously enough suggests that the vertebrae would be kept together even when thus used; and the comment of the scholiast upon the word in question seems to indicate that the way of utilising the muscles of the back for food with which he was familiar, was not such as to be described by such words as *νώτοισι διηνεκέεσσι*. It is easy to imagine that savages using flint knives only to carve with would be glad to be spared the trouble of disarticulating the vertebral column into segments, such as we eat under the name of 'chine'; and the deeper lying spinal and interspinal muscles and ligaments would keep it all bound together after they had devoured the more superficially placed soft parts. What they left would be flung on to their rubbish heap; from that it migrated, in a way to be hereafter suggested, into the skeleton shaft.

The fact that the lower jaws are invariably broken[1], so as to part the alveolar from the other parts of the bone, bears directly upon the employment of the bone for food, as does also the very scanty representation of the brain-containing part of the skull, or indeed of any part of the skull except the upper jaw. The absence of any manubrium sterni I should explain, following a hint given by Rütimeyer, by suggesting that it was found useful as a punch when the tynes of the red deer might have become scarce.

An old goat, *Capra hircus*, was represented in the series from this skeleton pit by a radius, a metacarpal, and metatarsal bone, and by four lumbar vertebrae. A kid was also represented by its metatarsal bones.

Two roes, *Cervus capreolus*, were also represented here; the femur and humerus of one had been split for marrow, and was slightly stained with the manganic oxide.

Bos primigenius may perhaps be represented by a couple of thick and rough nasal bones, as well as by a few other fragmentary bones of similar texture, and some much worn premolars. These may have got accidentally mixed up with the bones of the other animals found in larger quantities in this pit, some of the successful drivers of the *urus* having brought away its head from

[1] See Rütimeyer, 'Fauna der Pfahlbauten,' p. 14.

the fatal pitfall. They were found immediately below the ditch bottom.

No bone of red deer, *Cervus elaphus*, has come from this pit to my knowledge; a single tyne may have come from it, but its presence in this series I incline to refer to accidental mixing in more recent times than those just alluded to.

An undetermined fragment of bone, which may have formed part of a bone implement, is also referred to this 'Skeleton Pit.'

I have had entrusted to me, or found myself in this pit, bones of the shrew mouse, of the field mouse, of the toad, and a few teeth of a cub fox. I am not able to attach any importance to them. The important vertebrate animals in this series are, by their presence, the pig, the goat, and the roe, and by their absence, the red deer and the domestic ox, though possibly some of the few and fragmentary bones spoken of above under the heading *Bos primigenius* may be referable to that variety of the species.

In the Skeleton Pit—Skeletons of Sus scrofa v. domesticus are

Represented by—

4 right, 4 left	Scapulae
3 right, 3 left	Humeri
3 right, 3 left	Ulnae
3	Radii
4 right, 2 left	Femora
2 right, 2 left	Ischia
3 right	Pubic bones
3 right, 1 left	Ilia

Fragments of 6 lower jaws, the youngest with complete milk dentition, the oldest with third molar not quite in use.

Four sets of cervical vertebrae—

Of which set No. 1 is complete, and will fit with a set of 8 dorsal, 5 lumbar, and 2 sacral.

Set No. 2 is also complete, and will fit with a set of 12 dorsal and 4 lumbar.

Section No. 3 consists of 3 cervical vertebrae, which will fit with a set of 14 dorsal and 4 lumbar vertebrae.

Set No. 4 consists of 6 cervical vertebrae, which will fit with a set of 10 dorsal vertebrae and 3 lumbar, with which a right pubic bone and the jaws of a pig, certainly under five months, may be connected as parts of one skeleton.

A fifth set of vertebrae, containing no cervicals, but 6 dorsals and 1 lumbar.

In addition to the vertebrae here specified, there are 2 sacral, 1 caudal, 1 dorsal, and 3 lumbar, which cannot very easily be referred to any one of the five sets, but which, from one reason or another, do not speak very positively to the presence in the series of any part of a sixth skeleton. This fact, however, is proved beyond question by the lower jaws and the fragments of lower jaws contained in the collection.

In addition to the bones of the domestic pig already enumerated, there were very large numbers of ribs, nearly all broken, and a considerable number of phalangeal bones.

IV. *The mollusca found in the Skeleton Pit and their bearing on its date.*

The mollusca found in the Skeleton Pit, though they do not throw any light upon the habits, furnish an almost perfect demonstration of the relative antiquities of the pit-diggers, of the woman whose remains were found in the pit, and of the diggers of the ditch who came last of all, little suspecting what 'mouldered there below.'

The following species of mollusca were found in the pit, adhering to its walls, or amongst the rubble:—*Helix nemoralis*, *Helix arbustorum*, *Helix lapicida*, *Helix rotundata*, *Zonites cellarius*, *Cyclostoma elegans*. They were found in great abundance, but there is no reason to suppose that they had been used for food. There were no specimens of the large edible snail, *Helix pomatia*, found in Cissbury at all, and though the next largest English snail, *Helix aspersa*, was found in other parts of the works excavated, I have no note of it from the skeleton pit. Oysters which (see Colonel Lane Fox, l. c. 367) were found in one instance at the bottom of the ditch, were not found in any stratum deeper down, and may, therefore, like the horse, be considered as marking a later age. To understand the value of the argument for the antiquity of the shaft and the priority in point of time of the entombment of the woman, whose remains are hereinafter described, to the digging of the ditch, Colonel Lane Fox's section (fig. 3, Pl. xv, l. c.) of the skeleton shaft, with the ditch escarp and counterscarp, should be before the reader and be compared with his description given at p. 376, l. c., of the structural arrangements there figured. In the skeleton shaft (H, fig. 3, Pl. xv.) the larger snail shells, by themselves, are sufficient to show, firstly, that the ditch must have been cut through rubble continuous with that which we cleared out of the pit, to the great surprise, no doubt, as also to the great satisfaction of the excavators, who would find the work of cutting through rubble much easier than that of cutting through the natural chalk; and by consequence, secondly, that the shaft was anterior, not posterior, in date to the making of the fort. For it is simply impossible that such large shells as those specified could have worked their way in any abundance through the red seam of silting, made up of fine rain-washed particles, which marked the line of the bottom,

and was conformable with the sides of the ditch. The sudden and somewhat unexpected breaking through of this brittle flooring of red silt and the opening into the shaft beneath, out of which a large part of the skeleton had been extracted previously to my coming, by Colonel Lane Fox and Mr. Park Harrison, was a circumstance which, not only by virtue of its general sensational character, but also by forcing upon me the fact of the finely particulate, and therefore the rain-washed character of the red seam, made a great impression upon me. The red seam appeared, as it were, to assert its claim to belong to the lower strata by the abrupt manner in which it broke away, much as one geological stratum parts in an escarpment from one above it. As many of the snails below the seam were in large quantity, as well as individually of large size, it was a matter of ocular demonstration that they had in one way or another got down into the pit before the formation of the red seam of the ditch, and of the ramparts. The length of the galleries connecting shaft E with shaft H (fig. 1, Pl. xv.) rendered it impossible to think that the snails could have found their way into shaft H, as Colonel Lane Fox had done, by way of those galleries, and there seemed then, as there seems now, to be no escape from the conclusion that the ditch was a later, the shaft an earlier, excavation. The mollusca, however, furnished us with a stronger argument still. *For the shells of the Cyclostomata had, in a very great number of cases, their opercula still in relation with them.* This shows beyond all possibility of doubt that the animals had crawled down alive, and had not simply worked down as dead shells, a view which was further rendered untenable by the fact that in a great number of instances the shells, both of the *Cyclostomata* and the *Helias*, were adherent to the sides of the shaft. But they would not have crawled down in rubble to the depths at which we found them for any purposes of hibernation, nor could they, I think, have worked their way through the red seam so often referred to. On the other hand, the protection against both cold and drought which an open shaft only 4 feet 6 inches in diameter and more than three times those dimensions in depth, would offer to snails on a chalk down, very fully explains both their presence and their abundance. This latter point, viz. the great number of these snail-shells, and especially of the *Cyclostomata*, found in the rubble-filled shaft *below*, though not *above*, the red seam, calls for some consider-

ation. It might seem, at first sight, to indicate that the gallery and shaft excavators had left this pit open for a considerable time, departing herein from their usual custom. Snails, however, multiply with very great rapidity under favourable conditions, and the damp and protection from enemies, such as, notably, the pig, which such a shaft would have afforded, would constitute such favourable conditions. And it must be borne in mind that but little weathering of the sides of the shafts had taken place (see Professor Prestwich, 'Journal of Institute,' l. c., p. 386), and that the rubble with which this shaft, like the others, was filled up, was not altered, softened, or broken up, as it would have been if long exposed to rain and cold. Taking all the facts together, those, to wit, which are put before us in Colonel Lane Fox's Plate xv., with letterpress in explanation at p. 375, l. c.; those which I have before me in the very large collection of fragmentary and of perfect, of brute and of human bones, and those which the snail-shells represent, we may sum them up as follows:—A human skeleton, with nearly every bone represented, including the often missing patellae and fibulae, was found with its skull about 2 feet 6 inches from the bottom of a shaft, which must have been 14 feet deep originally, but which had got filled up some little way at the time of the falling of the owner of this skull into it. The skull rested on its base and lower jaw; one of the heel bones I found when I cleared out the upper part of the shaft from the 'red seam' marking the bottom of the ditch downwards, 1 foot $\frac{7}{8}$ inches higher up than the skull. This *os calcis* was lying upon a small outstanding ledge of the natural chalk which had been left projecting inwards from the sides of the shaft, on which it had caught, in what we must suppose to have been the sudden and somewhat ungraceful plunge of the woman into the pit. This fall must have bent the head round, as the crown was looking upwards when it was found. The space occupied by the skeleton from the *os calcis* to the crown of the skull was only 1 foot 7 inches, a distance only some 3 inches or so greater than the length of the femur; but that even this distance should have been preserved, it must have been necessary that a considerable quantity of supporting material must have accompanied the woman in her fall, otherwise the entire skeleton would have been found flat on the floor of the shaft. And, as a matter of fact, we found the bones of the pigs above enumerated mixed up confusedly with the human bones and

the rubble, in such a manner, that is to say, as to show that they had all come down together, that the human body must, in the singularly illustrative words of the Hebrew prophet, have[1] 'gone down to the stones of the pit,' with 'the carcases trodden under foot' of the lower animals above specified. I am not clear that any evidence is now procurable for deciding whether the woman 'went down alive into the pit' or not; there can be no doubt that her whole body, dead or alive, soft parts as well as bony, went down in its natural continuity. And it seems to me that the peculiarities of the collection of lower animal bones appear to necessitate the hypothesis of a rubbish heap having been accumulated close to the open mouth of this shaft, which rubbish heap must somehow or other have been precipitated simultaneously with a large quantity of rubble (from, possibly, shaft K, Pl. xv.) and the human body into the 'skeleton shaft.' It is of course easy to suppose that this was done by violence, and was an act of foul play. But it is also possible that a rash step on a mass of rubbish and rubble in frosty weather may have caused an avalanche-like descent of the entire mass of half-eaten bones, of rubble, and the living woman.

It may be objected, perhaps, that even a set of savages would scarcely have their dwelling-place and their rubbish so near so dangerous a thing as an open pit. To this it may be answered, firstly, that an examination of the pit showed that it had actually been allowed to stand open for some time at all events, a red seam of silting having had time to form itself at a lower level in the shaft than that at which the woman's skull was found, to say nothing of the snails, and of the weathering of the walls to which they were attached; and, secondly, that modern experience shows only too abundantly that very dangerous and life-destroying nuisances are often allowed to exist very near human dwelling-places. I have, indeed, sometimes thought that the proximity of the pit may have been thought desirable by the formers of the rubbish heap, as it may have been used as a sort of protective pitfall, affording something of security against marauders. If the woman, whose skeleton I shall now proceed to describe, can be supposed to have fallen into the pit whilst prowling round the hut which the rubbish heap implies, we can understand how it was that

[1] Isaiah xiv. 19.

she was left to lie as she fell and where she fell, a circumstance which needs explanation.

The skeleton found as above described, in the skeleton shaft under the ditch of the British fort at Cissbury, was that of a woman of about twenty-five years of age, of low stature, 4 feet 9 inches, with narrow shoulders and hips; but with a large head of the low-lying or 'tapeinocephalic' type, not rarely to be found, as remarked ('Journal Ethn. Soc.,' Jan., 1871, p. 467) by Professor Busk, amongst 'priscan,' as also amongst modern Tasmanian and Bushman skulls. As regards the limbs and the limb girdles, it may be remarked that their characters are such as very completely to remove any suspicion as to the assignment of the skeleton to the female sex which the large cubic capacity of the skull might excite. The measurements given below will speak for themselves, but it may be well to state that, though each bone as a whole gives an expression of lightness, and slightness, and consequently of feebleness in its owner, there are some muscular ridges developed with remarkable distinctness. The right clavicle is much shorter and less curved than the left, but its muscular markings for the pectoralis major, as also the markings on the humerus for the insertion of that muscle and for that of the latissimus dorsi, when compared with the corresponding points on the left side, show that this woman was not left-handed. The two muscles named may have taken on their increased development from exercise in climbing up and down the shafts of the flint-mines. The development on each femur of a third trochanter to receive the uppermost insertions of the gluteus maximus admits, I think, of being explained by a reference to the same practice, though the femora of the most eminently arboreal of the lower animals do not bear out this suggestion as regards the lower in the same way that they do as regards the upper limbs. The linea aspera is replaced by a depression from below the level of this third trochanter down nearly to that of the foramen nutritium of the femur, and for the distance corresponding with this depression the femur is much flattened and flanged out. The lower part of the linea aspera is much larger on the right side than the left, as though this woman had used the right lower limb by preference, as well as the right upper one. The tibiae are formed anteriorly platycnemic. Traces only of the lines of junction between the epiphysis of the clavicle

and its shaft, between the two epiphyses of the radius and its shaft, between those of the fibula and its shaft, and between the cristae ilii and the body of the bone are visible. The vertebrae are completed, and, what is somewhat surprising, the five bones of the sternum are all but completely anchylosed. There can, however, be no doubt as to the age of the woman to whom this skeleton belonged, inasmuch as the first vertebra of the sacrum is still unanchylosed, and the wisdom-teeth, though present in both jaws, are very little, whilst the other teeth are very much, worn. As regards the limbs, the scapulae, the pelvis, and the clavicles of this skeleton, what Dr. Kuhff has said ('Revue d'Anthropologie,' iv. 3, 1875, p. 435), viz. that 'plus l'on se rapproche des origines de l'homme, plus l'on voit s'effacer les caractères différentiels sexuels dans le squelette,' is the very reverse of the actual state of the case. As regards the cranial capacity it is otherwise, and the skull of this woman from the skeleton shaft at Cissbury, with a cubic capacity of 105 inches (=1732·7 cub. cent.=61·5 oz. av. brain weight), exceeds the immense majority of male skulls cubed and recorded. Out of a large series from very various times and peoples cubed by myself, three only have exceeded this amount. One of these was a Roman of the Romano-British period in Britain, with a cubic capacity of 108 inches; a second was a skull from a British tumulus at Crawley, of probably the time between the evacuation of Britain by the Romans and its entire subjugation by the Saxons, with a capacity of 106·75 cubic inches; the third is a modern European head, with nothing to note in its history, but with a capacity of 105·5 cubic inches.

I have so very lately, 'Journal Anthrop. Inst.' vol. v. p. 120, April, 1875 (Article xviii), and elsewhere ('Address on Anthropology,' British Association, Bristol, 1875), gone over the various rationales which have been offered to account for these, at first sight, somewhat startling results, that it may be superfluous to repeat here what I have already said *locis citatis*.

Looked at in the norma lateralis, as given in fig. 1, Pl. xix.[1] vol. v. of the 'Journal' of the Institute, the skull is seen to have the highest point of its vertical arc just at the coronal suture; the slope of the forehead is a little more pronounced than is usual in female skulls, but, on the other hand, the parieto-occipital region

[1] This plate forms one of the illustrations appended to Colonel Lane Fox's Report.

has the vertical dip which, as Ecker has pointed out, is so characteristic of such crania. As in typical dolichocephalic skulls, the glabello-inial is shorter than the glabello-postremal line, and the lambdoid suture comes largely into view. As in many 'priscan' skulls, the coronoid process of the lower jaw fails to pass above the level of the lower edge of the zygoma. The anterior margin of the squamous nearly (but not quite, as drawn in the figure referred to) reaches the frontal bone. The alveolar border of the upper jaw describes a curve strongly convex downwards, and broken into, in the horizontal plane, by the great prominence of the sockets for the canines.

The skull when placed without the lower jaw on a horizontal surface is supported by the first and second upper molars and by the conceptaculum cerebelli. When looked at in the norma frontalis this skull strikes the observer, firstly, as being eminently well filled or rounded out in the supra-temporal regions, but, secondly, as having the impression of culture which is given by this development neutralised by the peculiar conformation of the upper and lower jaws. The large size of the sockets of the canines in both jaws gives a squareness to that region of the face, whilst in the lower jaw the triangular raised area of the mentum is feebly developed, as compared with the alveolar part of the jaw.

The lower jaw, when placed on a horizontal plane, touches it with its inferior border on the left side only by a segment corresponding with the two anterior true molars. A wide interval separates the symphysis from such a plane, and though the angle of the jaw on the right side does aid in supporting it when thus placed, that on the left does not. Both angles are rounded off. The foramen mentale on the left opens a little further back than is usual in European jaws, viz. immediately beneath the second premolar. Just above it is seen the opening of an alveolar abscess in relation with the premolar, which appears to have been broken across midway between its crown and its neck during life, and to have had its pulp cavities consequently exposed. The apex of the coronoid projects only about one-tenth of an inch above the level of the condyle when the jaw rests on a flat surface. Coupling these peculiarities with the shortness of the coronoid and the worn condition of the two anterior true molars, we may say that the lower jaw would, if taken alone, have furnished a strong ground for conjecturing that

its owner had lived in early times. For though well-formed jaws are found in early cemeteries, it is certainly rare to find such a jaw as this in the burial-places even of the bronze period. The thickness of the bone is referable to the irritation which the only recently completed evolution of the wisdom-teeth, as well as the injured premolar, would cause; when allowance is made for this, the sexual characters of this lower jaw are as distinct as those of any other part of the skeleton, and notably its inferiority in the points of width and of muscular markings.

The lower parts of both nasals are lost; the upper halves form a broad and low arch, above which a moderately developed glabella passes without any mesial depression into similarly developed supraciliary eminences on either side. The left supra-orbital notch had, even at the early age at which this woman died, been converted into a foramen. Viewed from behind, the lateral walls of the occipital pentagon are seen to converge somewhat from the point of maximum width, which lies a little below the level of the faintly marked parietal tuberosities. In this aspect the skull is seen to narrow rapidly, as if pinched in, immediately behind this level of maximum width (see 'Journal of Institute,' vol. v. p. 124). The upper part of the occipital bone, however, though its sides are conformable with the posterior and inferior portions of the parietals, is not produced so far backwards as is sometimes the case in skulls of this type, and specially in male skulls, and, on account of this truncation, it does not come largely into view in the norma verticalis. In this aspect the sides of the cranium are seen, as we follow them forwards from the point of maximum width, to undulate gently inwards over a space corresponding with a shallow post-coronal depression, and then to taper very gradually to the region of the frontal tubera; as we follow them backwards they converge with much greater rapidity, but still without giving a sharply pointed occipital end to the vertical oval. It is aphaenozygous. A circular depression, about half an inch in diameter, is seen on the right parietal bone, its floor is covered with vascular ramifications, but the injury to which its formation is due had been recovered from long before death. All the cranial sutures in the vault of the skull are free from anchylosis, except the frontal, which, as usual, is closed, though it may be stated here that it is occasionally patent even in undoubtedly priscan skulls. The occipito-sphenoid suture

had been entirely closed before death, but there are some traces of the intermaxillary still visible upon the palate. The palate is well formed, deep, and elliptical. The wisdom-teeth alone have escaped degradation through wear, and as the entire set of teeth is present in the lower jaw and is similarly worn, this fact shows that this woman lived upon a coarse or ill-prepared diet.

The measurements of the bones and other points upon which the preceding statements are based are as follows:—

Measurements of the Cissbury Skeleton.

SKULL.

	Cub. inches.		Cub. inches.
Cubic capacity	105	Depth of lower jaw at symphysis	1·4
Circumference	21·3	Width of ascending ramus	1·45
Extreme length	7·7	Interzygomatic width, approximatively	4·6
Glabello-inial length	7·4	Cephalic index	·74
Extreme breadth	5·7	Antero-posterior index[1]	·53
Vertical height	5·85	Orbital index	·83
Absolute height	5·6	Nasal index	·45
Least frontal width	3·9	Distance from foramen occipit. to fronto-nasal suture	4
Greatest frontal width	5	Distance from foramen occipit. to nasal spine	3·75
Frontal arc	5·1	Distance from foramen occipit. to alveolar edge	4
Parietal arc	6		
Occipital arc	5	Basilar angle	23°
Height of orbit	1·3	Facial angles, taken with M. Broca's goniometer, to root of nasal spine	68°
Width of orbit	1·55	„ to alveolar edge	65°
Length of nose	2		
Width of nose	0·9		
Width of root of nose	0·85		
Length of face	3		
Interangular diameter of lower jaw	3·4		

LONG BONES.

Femur	15·8	Transverse diameter between most distant parts of ilia	9·1
Tibia	12·5	Length of scapula from glenoid fossa to vertebral border along spine	3·9
Humerus	11·3	Length along lower margin	4·6
Radius	8·6		
Right clavicle	4·8		
Left clavicle	5·4		
Transverse diameter from pelvis	3·8		

[1] See 'Journal of Institute,' Oct. 1875, vol. v. p. 149.

XX.

NOTES ON A SECOND SKELETON FOUND AT CISSBURY.

At page 431 of vol. vii. of the 'Journal of the Anthropological Institute,' May, 1878, will be found a short account by Mr. J. Park Harrison of the discovery of a second skeleton in the Cissbury Flint-works. This discovery was made at the end of March of that year, and having myself been engaged in the investigations carried on at Cissbury in 1875 (see 'Journal Anthrop. Inst.' vol. v. Jan. 1876, Article xix, General Lane Fox, 'Excavations in Cissbury Camp,' pp. 357 to 390, and vol. vi. 1876, pp. 20 to 36), I was sufficiently interested in Mr. Park Harrison's discovery to visit the scene of his operations on April 5, 1878.

On arriving I found that the skeleton had been carefully removed and committed to the guardianship of Dr. C. Kelly, the Officer of Health for the District, and now Professor of Medical Jurisprudence at King's College. To him, as to Mr. Park Harrison, my best thanks are due, for the information which they most kindly supplied me with as to the details of the 'find;' and to Dr. Kelly's professional knowledge and supervision the almost perfect recovery of the bones is to be ascribed.

The view which, partly from the data furnished to me by these gentlemen, partly from my own observations on the spot, I have come to entertain as to the history of this interment may be briefly stated thus:—One of the 'cave-pits' or shafts of the Cissbury flint mines[1] having been disused by the flint workers for some time, had got filled up to about one-half of its depth, just as several of these pits have got filled up since *our* opening of them, by the scaling

[1] For a ground-plan showing the particular shaft in its relation to the other shafts in its immediate neighbourhood, see Mr. Park Harrison's paper 'Additional Discoveries at Cissbury' in 'Journ. Anthrop. Inst.,' vol. vi. Pl. X. p. 413, May 1878, where it is numbered Shaft vi.

For a figure of one of these shafts as they appear when cleared out of the rubble which till recently filled them up, and as it may be supposed to have appeared, if we add by imagination a quantity of rubble to the bottom of it, when the flint workers had finished, see Mr. Park Harrison's paper, ibid., vi. Pl. XXIV. p. 432, May 1877.

off and tumbling down of the more loosely compacted strata of the chalk forming its wall on to such rubble as its excavators had left on its bottom to save trouble. When this process had been arrested, owing to the less firmly compacted and coherent parts of the walls having been all removed, under the influence of frost and rain, sufficiently long to allow of the formation of a layer, half mortar half red mud, at the bottom of the downward pointing conical depression which the desquamation of these *débris* had formed, we may, with the aid of a heliotype taken from a photograph by Messrs. Russell, of Worthing, under the superintendence of Mr. Park Harrison and Dr. Kelly, reproduce in imagination the flint workers in the act of depositing on the smooth surface thus formed the dead body which the skeleton represents. The corpse was laid upon its right side, with its face to the East, with its knees within less than half a foot from its chin, with its lower legs bent back upon the upper, and with its fore-arms similarly at right angles to the long axis of its trunk; in one word, that is, in the 'contracted' position. In front of its knees a large flint hatchet of oval contour[1] was placed, and the body was then surrounded by blocks of chalk and some large unworked flints ranged in greatest prominence round the back aspect of the trunk, head, and limbs, but forming also a less conspicuously marked fence in front of the dead body. Some eight shells of *Helix nemoralis* and a fire-marked pebble appear to have been placed with the body, and after this had been done, the flint workers must have piled chalk rubble over their deceased comrade to a height of about a couple of feet, and having thrown or put in some half-dozen flint implements a little above and behind the spot occupied by the shoulders of the corpse and just outside the line occupied by the line of chalk blocks, they must, so far as the relics left to our inspection can show us, be supposed to have considered the interment completed.

[1] The implement is the one spoken of by Mr. Park Harrison, l. c., p. 431, as lying 'near the head in front.' There was only an interval of seven inches between the patellae and the skull. Some few worked flints were found, as was also reported to me by Dr. Kelly, around and on a level with the skeleton. [From a letter written Oct. 1878, by Professor Rolleston to Mr. Park Harrison, which the latter gentleman has given me the opportunity to read, it would appear that Dr. Rolleston had modified the view expressed in the text, and was disposed to agree with Mr. Harrison that the level surface on which the body lay was prepared for it entirely by man's hands and not by a dribbling down of earth before the place was chosen for the deposit of the body.—EDITOR.]

Subsequently to the interment, the history of the filling up of the pit must have been very much the same as has been the history of the filling up of the pits excavated and observed during the last half-dozen years by ourselves. In a section of such of the contents or filling in of the pit as Mr. Park Harrison had left in the position which they had assumed in falling into it, two other red streaks, besides the one on which the skeleton had been placed, were visible. The first of these describes a somewhat conical contour with the apex of the cone reaching downwards to the level of the couple of feet of chalk which we suppose to have been heaped over the body as deposited, and with the base prolonged upwards to a place more than half-way from its apex to the surface of the ground. And we must suppose this red streak to have been formed simply by the deposition of the lowly soluble alum- and iron-silicates, the rain carrying away with it to lower levels the more soluble calcareous element of the chalk it fell upon. This red streak is, to the eye, just like the red layer found capping the natural surface of the Downs, and the two layers may therefore, with considerable probability, be considered to have been both formed in the same way.

The former, however, of the two layers contained traces of lime and magnesia, and may have been deposited in a comparatively short time, as the square surface of chalk made up firstly by the walls of the pit, and secondly by the heaps of excavated rubble which no doubt surrounded its mouth, must have been comparatively great. Within the boundary, constituted by this red streak, were contained alternately strata of fine chalk and of medium sized rubble, more or less interpenetrated and agglutinated by still finer water-deposited chalk.

These contents of this upper crateriform cavity we may reasonably suppose to have fallen into it under the influences of rain and frost acting upon the exposed chalk surfaces just mentioned. Above them a second red streak was to be seen at about the level of the natural surface stretching more or less horizontally across the section. It appears to have been continuous at the walls with the other downward dipping red streak, very much as the upper or anterior of the two conical sacs forming the surface net used for catching sea animals is continuous with the lower.

The more thorough washing which its longer exposure had given

this uppermost streak of red mud had washed out of it all the traces of lime and magnesia which were found in the lower streak when examined chemically in Oxford.

Two more layers were visible above this red streak; the lower of them was made up of chalk blocks, forming a structure of from 1½ feet to 2 feet thickness. These blocks may obviously be supposed to have been some of the blocks which had been taken out of the pit whilst it was being excavated, and which after a long sojourn outside of it—long enough to allow of the formation of this second red streak—had finally, either by man's aid or that of some other motor force, been returned 'into the hole of the pit whence they were digged.' The upper of the two layers was made up of the black mould from vegetable *débris* which forms the bottom of so many of the cup-shaped depressions so characteristic of Cissbury.

The 14 or 15 feet which intervened between the red streak, about 5 feet long, upon which the body had been laid, and the natural chalk at the bottom of the pit were occupied with large blocks of chalk and smaller *débris*, which being of much the same character as the contents of the horizontal galleries in their neighbourhood may reasonably be supposed to have been left at the bottom of the pit to save the miners the trouble of carrying them up. They were much agglutinated by fine infiltrated chalk which had been deposited as the downward passing rain lost more and more of its carbonic acid.

It was in this deeper portion of the shaft that the following animal remains were found: a horn of goat (*Capra hircus*) which came from a level 23 feet from the surface; some horns of red deer (*Cervus elaphus*) which came from a level 20 feet from the surface; and some others from the galleries which branched off from the bottom of the pit some 7 feet lower. In one of those galleries an ox's scapula was found, April 8th [1].

Stone implements were found in considerable abundance in this portion as in the rest of the filling up of the shaft. Some of them were also of considerable beauty, as notably one found 6 feet from the bottom of the cave, April 6th. It is worthy of notice that four lumps of iron pyrites were found near the mouth of one of the galleries, and about 4 feet to 5 feet from the bottom of the pit; and near them were found from 300 to 400 flint chips in a heap. In

[1] For use of scapula of ox as a shovel, see Gen. Lane Fox, l. c., p. 383.

this collection we have an indication as to the place where the flints were worked up into weapons; and the marks of fire which have been supposed to have been found there may indicate that the presence of a fire was found desirable and secured by the workmen of those early days. I do not, however, lay much weight upon this latter suggestion, chiefly because I think that the marks of fire would have been more obvious and less ambiguous[1] than they are if the lighting of a fire had been a very common practice with the flint-miners.

Part of the lower jaw of an ox (*Bos longifrons*) has come into my hands from those of Mr. Park Harrison, with the note '16 feet,' i.e. that of the level at which it lay in the pit, upon it; and a fragment of the femur of a tame pig (*Sus scrofa*, var. *domestica*) appears, though the labelling is a little indistinct, to have come from a higher level, viz. that of 11 feet.

The further history of this shaft has been obtained from the postscript to Mr. Park Harrison's paper, 'Journ. Anthrop. Instit.' vol. vii. May 4th, 1878, p. 424 and pp. 431–433, and from additional information furnished to me by that gentleman and by Dr. Kelly. In following up the excavation of Shaft vi. (shown on the plan, Pl. X, l.c.), the workmen came first at a little distance above the level of the skeleton, and, as was afterwards made out, over its left shoulder, upon six flint implements of about 4 or 5 inches long, and subsequently upon the cist round the skeleton, and then upon the skeleton itself. This skeleton is that of a man between twenty-five and thirty, who had suffered from hemiplegia when a child, but had sufficiently recovered to take an efficient share as a flint-miner in the labours of the surroundings in which his remains were found. His had been a formal, that of the female from Cissbury, already described by me ('Journ. Anth. Inst.' vi. 1876, Article xix), an accidental interment; but the bones of the two skeletons and the relics found in company with them show that their owners lived probably about the same time, were themselves of about the same age though not of the same sex, and followed the same avocations.

I spoke (page 423) of the skeleton previously found in one of the

[1] *Some* of the black deposits which in other shafts had been supposed to have been due to fire, turned out, when examined microscopically, to be of a vegetable nature, and to be, possibly enough, identical with the *Protococcus lugubris* of Professor Leidy, of Philadelphia.

Cissbury flint-mine-shafts as having belonged to a 'woman of about twenty-five years of age, of low stature, 4 feet 9 inches,' and very much the same words might be used for describing the male skeleton now before me. Some little doubt might have arisen as to the question of the sex of this skeleton in the mind of anybody who might have chanced to put his hand upon the long bones of the left arm on first seeing the skeleton. For these bones are disproportionately short as compared with ordinary male humeri, radii, and ulnae, as their measurements will show; and it is only when they are compared with the corresponding bones of the other side of the body, and found to be much shorter than those of ordinary male bones, that we see that this shortness has a pathological, not a sexual significance, and is to be explained as having been caused by infantile paralysis which was partially recovered from. There is, however—when we examine the other bones of the skeleton, happily, through Dr. Kelly's help, nearly all available for this purpose—no doubt as to the sex of the owner of this skeleton. As regards the limb bones even of the left arm, their markings for the insertions of muscles are much better defined, and their absolute dimensions are larger than those of the skeleton already described, and the same applies, *mutatis mutandis*, to all the other bones. The orbital ridges, the mastoid processes, the parieto-occipital and the frontal slopes in the cranium, the lower jaw and the pelvis, all alike possess the characters which are held to indicate the male sex.

I spoke of the age of the Cissbury female as having been 'about twenty-five years,' and I think, as this phrase may be taken to cover the quinquennial period from twenty-five to thirty, it may be considered to have been scientifically as well as otherwise justifiable. It is difficult to pronounce definitely as to whether the male skeleton now before us belonged or did not belong to an older individual than the female already described. In both, the epiphyses of the movable vertebrae have coalesced with the centra, those of the ossa innominata and those of the ribs and clavicles with the rest of those bones, whilst in neither have the first and second sacral vertebrae coalesced, which they usually do about the thirtieth year. On the other hand, the lines of junction of these epiphyses are a little more evident in the male than the female skeleton, and the teeth are not quite so much worn down, so that

the male may be supposed to have belonged to a somewhat younger individual. In the male skeleton, again, the manubrium sterni is not anchylosed to the body; but this anchylosis, as visible in the female skeleton, must be considered an abnormality, explicable, possibly, by some peculiarity of diet, as it does not usually supervene till advanced life.

That the owners of the two skeletons under comparison were really workers in the flint mines in which they were found, is rendered probable by the markings of their long bones, of which mention has already been made in the description of the female skeleton (page 423). The insertion of the deltoid, a muscle greatly employed in climbing, is very prominent in both humeri of the male skeleton, but especially in the right; the insertions of the greater pectoral and of the latissimus dorsi, which take such a large share in pulling the body after the upwardly extended and grasping arms, assume, as in the gorilla, the shape of long, roughly undulated, depressions; the anterior border of the bones, from the upper end of the insertion of the pectoral down to that of the deltoid, describes a curve convex forward to an extent which I have not noted in other human humeri, but which is very similar to that described by the anterior border of the platycnemic tibiae. The musculospiral grooves are poorly marked; but the flat lower part of the posterior surface shows much more signs of the implantation of muscular fibres than is usual even in much more powerful humeri. All the four ulnae of the two skeletons now before us resemble each other, in having the lesser sigmoid notch for the cylindrical head of the radius shallow and poorly defined, whilst the lower edge of the bone describes a much more marked carinated curve, extending over a distance of 2½ inches by 3½ inches, from the level of that notch forward, than is usual in human ulnae. These peculiarities are, according to M. Broca, noticeable in certain anthropoid apes (see his 'Mémoires,' tom. ii. p. 181); but like the somewhat similar tibial platycnemy, they are more pronounced in the human than the simian bones.

Setting aside the sexual disparity, which is so often observable in an exaggerated degree in the limb bones of uncivilised races (see 'British Barrows,' p. 659, and this volume, p. 257), the lower limb bones are, like the upper, curiously similar in the two skeletons, and may have their similarity explained in like manner by reference to

the climbing which must have formed a considerable part of the labour of the flint workers. The femora in both have the same third-trochanter-like facets for the insertion of the gluteus maximus; in both the right femur has its linea aspera much more prominent than has the left, though the bones of the two opposite sides are in both of the same length; in both alike is the bone flattened or flanged out in the region of the insertion of the gluteus maximus. In both alike the tibiae are platycnemic; though by the much greater development in the male tibiae of the oblique 'soleal' or 'popliteal' line, and its prolongation on to the internal aspect of the bone which thus gives insertion or origin to more or less of three muscles, the soleus, the popliteus, and the flexor communis digitorum which do not encroach upon it in normal tibiae, this platycnemy is made much more striking. The platycnemy, it may be remarked, even of the gorilla, *Troglodytes gorilla*, never proceeds so far as this; though the tibialis posticus takes origin from the outer, the flexor takes origin from the posterior, not from the internal aspect of the tibia. As regards the pathological peculiarities of the male skeleton, it is observable from the annexed measurements that the femora have not suffered at all from the right hemiplegia, which we may suppose to have been the cause of the diminution of size of the following left side bones; the left tibia and fibula being $\frac{3}{10}$-inch less in length, measured from astragalar articulating surface in contact with fibula, than the right; and the left humerus $\frac{5}{10}$-inch, the left radius $\frac{3}{10}$-inch shorter than the right. With the exception of the shortening, the left limbs do not appear to be inferior in development to the right, in any degree exceeding that which is ordinarily observable in individuals who are, as savage races usually, and civilised very generally, right-handed. The difference which exists between the extent to which this shortening has affected the lower and upper limbs respectively, is an instructive commentary on the following generalisations which Sir Thomas Watson has based upon his experience and studies ('Principles of Medicine,' 5th edition, 1871, p. 469):—

'Supposing the patient to recover wholly or partially from the paralysis, it is the leg, in nine cases out of ten, aye, and in a much larger proportion than that, which recovers first and fastest; sooner and quicker than the *arm*, I mean. And another fact, quite analogous with this, is that when one of the extremities alone is affected with paralysis it is, in nineteen cases out of twenty, the arm that is so affected. In general hemiplegia from cerebral lesion the palsy of the leg is commonly less complete, and is sooner recovered from than the palsy of the arm.'

An abnormal depression, $\frac{4}{10}$-inch long, of the shape of a segment of the lateral sinus in the cranium, exists immediately internally to the rough oblique line corresponding with part of the upper and outer limit of the origin of the soleus for the posterior surface of the fibula of the left side. This may possibly have been produced by the malnutrition caused by the temporary hemiplegia. But no other lesions of this kind, if such it be, have presented themselves to me elsewhere in this skeleton.

The cranium of the male skeleton contrasts with the female, already described, page 425, in the following particulars:—

When placed on a horizontal plane, and viewed in the *norma lateralis*, without the lower jaw, the skull rests on the occipital condyles and the first molar and the teeth anterior to it, whilst the female skull, when similarly placed, rests on the conceptacula cerebelli and the first and second molars, showing thus at once a greater cranial curvature, which is a sign of elevation, and a greater convexity downwards of the upper alveolar line, which is rather a sign of the reverse. The male skull is more orthognathous than the female, whilst the slope of the forehead is more oblique, as is usual in male skulls. The same applies to the obliquity in the parieto-occipital region. The frontal and parietal regions are, as the measurements of their absolute widths show, less well filled out and globose than those of the female skeleton; the muscular impressions show the large development to be expected in a male subject. The ear is seen, as the low antero-posterior index (·48) indicates, to be placed far forward in the skull. The origin of the temporal muscle from the frontal and of the masseter from the malar bone are marked by rugged lines; there is a large foramen emissarium in each temporal bone posteriorly to the digastric fossa, in compensation, as it were, for the existence of but a single small one in the place of the normally present pair in the parietal region. Viewed from behind, the parietal tubera are so faintly marked as to mask somewhat the pentagonal contour which the falling away of the parietals from the middle line of the skull on either side, together with the comparative flatness of the temporal regions, would otherwise give. Viewed in the norma verticalis, the skull is seen to be phaenozygous; to have the denticulations of the sagittal suture somewhat coarse where present, and to have the fused halves of the frontals sloping away from the middle line. When the

skull is viewed from the front, the lowness of the orbital and the height of the nasal indices are very obvious; the end interzygomatic diameter forms the base of a triangle with its apex at the middle line of the frontal; but inferiorly, the flanging out of the lower jaw at its angles diminishes the relative superiority of this transverse measurement. The malar portion of the orbit has its edges everted. The supra-orbital portion is strongly developed, and bridges over the supra-orbital foramen. The supra-ciliary ridges are distinct from the supra-orbital, and meet across the middle line. The frontal sinuses are far from being co-extensive with them.

The lower jaw of this skull contrasts in very many important particulars with the lower jaw of the other skull from Cissbury ('Jour. Anth. Inst.' l.c., p. 34, and Article XIX. p. 425). The body of the bone, instead of having its symphysis separated by a wide interval from a horizontal plane upon which itself rests, has an all but perfectly horizontal boundary line inferiorly, upon which it would rest in its entire length but for a small downward growth in the region of the symphysis, and a slight rounding off of its angle, the general contour of which is quadrangular; when thus resting on a horizontal plane, it has its coronoid process projecting considerably above the level of the articular surface of the condyle, and when placed in its normal relation with the skull it has this same process prolonged a considerable way into the zygomatic fossa; a line drawn along the lower margin of the body of the bone makes an angle of but 103° with one drawn along the posterior aspect of its ascending ramus as opposed to the angle of 133° made by the same lines in the other lower jaw from Cissbury; and the teeth are less worn and of smaller size, and the body of the jaw less tumid, though the age was about the same and the sex male as opposed to female. If the regions of the symphysis of the lower jaws differ very much when looked at from the front, they differ even more when looked at from behind. The posterior aspect of the symphysis of the lower jaw can be naturally divided into two segments, one anterior, the other posterior to the tubercles for the geniohyoglossi and the vascular foramen just in front of them. If we place the point of one arm of a pair of compasses in this pretty constant foramen, and take with the other, first, the distance to the alveolar, and secondly, the distance to the mental edge of the symphysis, we

shall very rarely fail in the lower races of mankind to find the former of these distances much exceed the latter; and it is certainly only in the lower jaws of the higher races that we find the opposite proportion to prevail. So that if it were not wearisome to add to the list of indices, an anteroposterior index might be established for comparing the relative proportions of the two segments of the usually curved line described by the posterior surface of the symphysis.

The length from the foramen specified to the alveolar edge of the symphysis is in the female jaw 1·1 inch as against ·85 inch in the male, whilst the distance from the same foramen to the mental border of the symphysis is in the female jaw ·6 inch as against ·7 inch in the male.

The following general conclusions appear to be deducible from the foregoing descriptions and comparison of the two Cissbury skeletons:—

Firstly, that from the osteological peculiarities either of the cranium or of the lower jaw, or of the trunk and limbs, or of the skelelon as a whole, arguments of considerable cogency may be drawn for or against the 'priscan' date of a human skeleton, independently of the arguments to be drawn from its archæological surroundings.

Secondly, that in skeletons proved to be priscan by both the above lines of argumentation, points of difference will still be found to exist, independent on the one hand of points of sexual difference, and in spite, on the other, of any tendencies to uniformity, which the supposed uniformity of priscan life may be thought likely to produce.

MEASUREMENTS OF MALE SKELETON FROM CISSBURY, APRIL, 1878.

Measurements of Skull, Face, and Lower Jaw.

Extreme length . . .	7·3″	Absolute height . . .	5·6″
Fronto-inial length . .	7·25″	Circumference . . .	20·5″
Extreme breadth . . .	5·2″	Basicranial axis approximately	4·0″
Upright height . . .	5·7″	Cubic capacity not taken	

Minimum frontal width	3·7″	Breadth of face	4·9″
Maximum frontal width	4·5″	Height of orbit	1·3″
Maximum occipital width	4·5″	Width of orbit	1·6″
Frontal arc	5·	Length of nose	1·85″
Parietal arc	5·1″	Width of nose	1·0″
Occipital arc	4·6″	Depth of lower jaw at symphysis	1·3″
Basio-subnasal line approximately	3·7″	Width of ramus	1·5″
Basio-alveolar line approximately	3·7″	Interangular width	4·
Length of face	2·3″	Mandibular angle	103°

Measurements of Trunk and Limb Bones.

Length of right femur	15·7″	glenoid fossa to posterior inferior angle of right scapula[1]	6·6″
Length of left femur	15·7″	Distance between the widest apart points of ilia	10·0
Length of right tibia	12·2″	Distance between front of symphysis pubis and the sacral spines	6·3″
Length of left tibia	11·9″	Angle at symphysis	35°
Length of right fibula	12·4″	Antero-posterior diameter of true pelvis	4·8″
Length of left fibula	12·1″	Transverse diameter of true pelvis	4·6″
Length of right humerus	12·8″	Oblique diameter of true pelvis	4·7″
Length of left humerus	11·5″		
Length of right radius	8·9″		
Length of left radius	8·1″		
Right clavicle	5·1″		
Left clavicle	5·2″		
Distance from upper limit of			

Indices.

Length-breadth cranial	71
Length-height cranial	76
[2]Antero-posterior	48

Angles.

Basilar	30°
Facial at alveolar border	74°
Facial at nasal spine	76°

Stature, as calculated from lengths of femur, 4′ 9″. The entire skeleton, as laid out with spacing between vertebrae, occupied a length of 4′ 10″·5, to which an inch should be added for scalp and plantar soft parts, making in all a stature of 4′ 11″·5.

[1] This measurement only admits of being approximately obtained in the female skeleton with which we have been comparing it, it is however about an inch less, a significant fact not without parallel in prehistoric skeletons.

[2] For this Index, *see* 'British Barrows,' 1877, pp. 563, 667, and this volume, Article XV. p. 167.

XXI.

REPORT OF EXCAVATION OF A TWIN-BARROW AND A SINGLE ROUND BARROW AT SIGWELL (SIX WELLS), PARISH OF COMPTON, SOMERSET.

THE following account of the examination of three round barrows at Sigwell, in the parish of Compton, Somersetshire, two of which were in juxtaposition and may be spoken of as a twin-barrow, whilst the other stood apart from any other barrow, but overlooked what we hold to have been a camp of an earlier period than these barrows, throws light upon the following questions.

Firstly, it shows that in the Bronze age, and amongst men who were practising cremation, considerable variety existed as to the mode of their disposing of the dead. In the two burials discovered no urn had been employed, and the bones had been picked out of the pyre and placed apart, one set in a bark coffin, the other simply in a separate place in the soil of the barrow. Yet in one of the barrows pottery was found of a kind which showed with some probability that urn burial was not unknown to the original constructors of the barrow.

Secondly, the measurements of the entire mass of each barrow, as compared with those of the very small spaces in which the burned bones were contained, in one case within a circle of 6 inches radius, will show how exceedingly easy it must be to overlook the existence of such a burial, and how cautious we should be in asserting that nothing can be found in such mounds to serve as their *raison d'être*.

Thirdly, the relative position and elevation and other peculiarities of one of these barrows, that to be hereinafter spoken of as 'Sigwell iii,' and of a small British camp, show, as we believe very unmistakeably, that the camp was earlier in point of date than the barrow, and the work of stone-using, not of bronze-using, men.

This exploration was undertaken at the suggestion of the Rev. J. A. Bennett, the rector of the neighbouring parish of South Cadbury; and to his other suggestions on many points, and to his help throughout, we are greatly indebted.

The British Association gave us a grant towards the defrayment of the expenses, and the following report was read before the Plymouth Meeting in August, 1877.

'Sigwell i,' July 18, 1877, Tuesday.—The examination of the twin-barrow was begun by opening the tumulus situated to the north by a trench 9 feet 1 inch wide from the east side. The natural soil, lias sand, was of a light yellow colour with concretions of a small size and somewhat darker hue intermingled with it, and was readily enough distinguishable from the made earth of the barrow, which was darker in colour owing to finely divided carbonaceous matter, and was also more loosely compacted. The natural soil was 5 feet below the top of the barrow at its eastern edge, and 9 feet below it at its centre. When the excavation had passed the centre westward, it was opened out northwards to a length of 21 feet.

July 19, Wednesday. A great deal of charcoal was found about 4 feet above the natural surface at the centre; and at a depth of 1 foot 6 inches from the natural bottom, and 7 feet 6 inches from the surface under the centre picket, a well-formed flint 'scraper' or 'strike a light' was found. And in all about twenty fragments of worked flint were found in this barrow, some of them with *patina* upon them, and some with rose-coloured staining (from manganese?), but most retaining the black surfaces of their original fractures unchanged, and showing thereby that they were chipped during, or only shortly before, the erection of the mound, for the purpose of funeral ceremonial. But in this northern part of the twin-barrow we found no pottery, no bronze, no interment; and the flints, such as they were, were much fewer in mere numbers than in either of the two barrows to be hereafter described. Our failure to find any interment may be explained by the fact that this mound was very extensively burrowed into by badgers, foxes, and rabbits; and if the interment had been contained within as small a compass, and had consisted of such easily scatterable materials as those contained and discovered in the two other mounds, it is easy to see how it might have been entirely dispersed and destroyed.

'Sigwell ii,' July 20, Thursday.—We commenced upon the

southernmost of the two halves of the twin-barrow, driving a trench 15 feet wide from east to west, beginning along a line 30 feet south of the line of the centre picket, but some little way from the actual southern boundary of the barrow. Some excavation had been made, either for the sake of investigation or for digging out rabbits, fox, or badger, on the south-east side of the barrow; the earth disturbed by this operation had been partly thrown out eastwards, partly filled in again; through the westward part of the disturbed soil we dug, and found that the diggers had not gone very far down and had left a 'steel' for striking a light and a piece of glazed pottery in their 'filling-in.' We came upon the natural surface at a depth of 9 feet 10 inches, as in the northern barrow, the ground and the mound being of the same distinctive character as regards each other.

A piece of British pottery (labelled 'Sigwell ii a') was found 15 feet 6 inches to the south-west of the centre picket, and 9 feet 10 inches below the surface. It had been apparently the bottom of a jar or urn, and may possibly indicate that an urn burial had taken place in this barrow before the one we had to deal with. The distal half of the metacarpal or metatarsal of a sheep or goat was found about 5 feet down in the barrow near to the centre picket. It was a good deal decayed, but one of the phalanges was found in relation with it.

3 feet 8 inches to the west of the centre picket we found a grave 1 foot 6 inches deep in the natural soil, 10 feet long, 5 feet wide at the north, 4 feet wide at the south end, its long axis due magnetic north and south, that of the tumulus itself being about north 5° east. The eastern end of the grave was 7 feet to west of the centre picket, 3 feet 10 inches of the length of the grave being to the south of the centre, and the remaining 6 feet 2 inches to the north. In this grave was contained a bark coffin, inside of which was a bronze dagger, and a quantity of very thoroughly burnt small fragments of human bones. The longest diameter of the largest of these fragments being only ·9 inches, it is difficult to say more than that this fragment, being apparently a part of that portion of the occipital bone which is known as the Torcular Herophili (the very same portion of bone as that which was found in the deposit of La Tinière, and one which possesses a singular power of resisting various destructive agencies), probably belonged to a young male

subject. With this and one or two more fragments of skull there were some fragments of the long bones. With the white fragments were mixed up here (as also in 'Sigwell iii' to be hereafter described) masses of bones so burnt and so broken up as to present an Oxford grey colour from the intimate intermingling of their white with their carbonised factors. With the bones were mixed up inside the oak bark coffin some flint flakes labelled 'Sigwell ii c;' but not a single fragment of charcoal. It had been made of two pieces of bark, which had been fastened together at the sides, so as to leave two free ends projecting freely, not wrapped round each other. But in one section drawn by General Lane Fox the upper bark cover having been shorter than the lower, this latter simply curves round its free edge. As the ensuing description will show, the lower piece of bark must have been laid upon the ground, and the bones from the pyre or ustrinum must have been brought to it and placed upon and along it together with the earth and the bronze dagger, and the flints which were found inside the coffin by us. The upper piece of bark was then put over the entire mass of contents, and the rest of the barrow piled over them.

The coffin's east edge was nearer the east border of the grave than its west edge was; at this edge it was about 1 foot 2 inches short of the grave's boundary. Its length was, from south to north, about 7 feet; in working from south to north we had cut away the south end of the coffin before we were aware of it, so that we cannot say with perfect certainty where its south end began, but as its north end was detectable 2 feet from the north end of the grave, the entire length of which was only 10 feet, this is of no great consequence. The width of the coffin was from 34 inches to 36 inches; its depth in the middle line about 6·5 inches.

The contents of the bark coffin contrasted very strikingly with the made earth of the barrow above, with the natural soil into which the grave was sunk on either side, and thirdly with the soil from the grave itself, which had been thrown up on the east side of the grave as seen and shown in the section. The soil within the coffin was lighter a good deal than the made earth of the barrow, the intermingling of which with fairly divided carbonaceous matter had made it in places very dark; but was much less light than the natural ground into which the grave was sunk. But it is of great

importance to note that in the soil inside the bark coffin no fragments of charcoal sufficiently large to be detected with the naked eye were visible; as hence we see that the body was burnt some distance away from the grave, and that the burnt bones were picked up out of the ashes and carried to the grave separately[1], being distributed as deposited throughout the entire length of the coffin examined. The upper bark was much thinner than the lower, the lower being as much as seven-eighths thick, whilst the upper was as little as one-fifth to one-fourth. The upper piece had split in some places and the sand had worked away into the space left empty. *In situ*, the layers of the bark towards the interior were black, and the outer reddish; but, on drying, the reddish colour is in many pieces the colour throughout the entire thickness of the bark. Microscopic examination showed no dotted cells, and the Scotch fir is thereby excluded, but it is possible that it may have come from the Wych elm. Its structure, however, had been made exceedingly difficult to examine by the ravages of a fungus.

In this coffin, together with the bones and two or three flint chips, was a bronze dagger with three rivets, 6·5 inches long from proximal rivet to point. It was much decayed, and did not rest on the bottom of the coffin, but was separated from it by a considerable thickness of dullish yellow sand. Its point was broken away for a length of 7·10 inches, and this part was brought away on a piece of the hardened sandy earth. This lump of earth is preserved with a little of the crumbled-away part of the point adherent to it; the greater part of the point, however, has been attached, together with the rest of the blade, to a piece of cardboard. The lamina which held the rivets has broken up, and the small fragments of bronze diffused throughout the soil in the bottle labelled 'Sigwell ii b' represent it.

The dagger lay near the southern end of the grave, about 2 feet from the end; its pivot end was at the south, its point at the north. An interment which must have been of a somewhat similar character is described by Mr. Spence Bate, F.R.S., in the 'Transactions of the Devon Association,' vol. v. 1872, pp. 555–556. There 'a mass of comminuted bones mixed with earth, instead of being

[1] For the picking up of burnt bones see Max Müller, Die Todtenbestattung, Zeitchrift der Deutschen Morgenländ. Gesell. vol. ix. p. 17; Colebrooke, 'Life and Asiatic Researches,' vol. ii. *ibique citata*.

enclosed in an urn, were found lying closely placed together in one spot beneath the stones.' And in the earth that was carted home, 'besides a quantity of bits of bone, was found the blade of a bronze dagger.'

'Sigwell iii.' Monday, July 23.—Commenced work with seven men upon the barrow to the south-west of Sigwell camp by cutting a trench 17 feet long and 12 feet 6 inches wide to south-west of centre picket. This barrow resembled the two already described as 'Sigwell i' and 'ii' in the material and mode of its construction; in containing burnt bones which had been picked out of the ashes of the fire in which the body they belonged to had been burnt and buried apart; and in containing fragments of coarse pottery it resembled 'Sigwell ii,' but differed from it in not furnishing any specimen of bronze, and in, perhaps by way of compensation, furnishing a very large number of worked flints, some black, others whitened on their fractured surfaces, and in containing a small fragment of a patterned drinking-cup or food-vessel, and a very much larger quantity of human burnt bones as well as two large fragments of unburnt bones, an os innominatum, to wit, and a piece of a femur.

Among other important lessons taught by the history of this barrow, one of special importance is the ease with which it is possible to miss an interment when that interment lies within a circle of half a foot radius, and consists only of a small quantity of either very finely comminuted or all but pulverised burnt bones.

A good scraper, labelled 'Sigwell iii c,' was found 3 ft. 5 in. south-west of the centre picket and 4 ft. 7 in. below the level of it. All through this barrow worked flints were found in much greater abundance than in either of the other two. I was inclined to connect their presence in this quantity with the absence in this barrow of any rabbit-holes, supposing that a rabbit in burrowing would be likely to throw out a worked flint rather than an equivalent mass of sand for obvious reasons, mechanical and other. But I should not press this view.

Exactly beneath the centre picket, and 6 feet below it, was a mass of burnt bones occupying a circle of about a foot in diameter. The bones belonged to an adult, sex uncertain. In two other spots in the barrow two other bones were found, viz., a fragment of a right os innominatum, the acetabular portion of which is so shallow

as to suggest that it has been affected by disease and absorption, and a fragment of a femur also of the right side. The burnt bones, 'iii d,' were in much greater quantity than those found in 'Sigwell ii,' and had some, though very little, charcoal amongst them: differences which may be accounted for by the place in which they were burnt having been in close proximity to the place where we found them. The place of burning we discovered thus. At a distance of 1 foot 9 inches below the burnt bones there was a thick seam of burnt wood 4 inches thick, and the floor below the ashes, at a spot a little to the north-east of the centre, was very much reddened, showing that a fire had been lighted and had burned with much intensity upon it. In these ashes on the floor of the barrow were a few fragments of human bone, 'iii. e,' well burnt, like those above, which we may suppose, therefore, to have escaped the careful out-picking which had removed so large a number of the burnt bones from interminglement with the ashes, and had placed them together, as described, on the top of a mass of earth, piled up to a height of nearly 2 feet above the site of the pyre. A similar up-piling of earth must have taken place in the bark coffin in 'Sigwell ii,' as the description shows, and a similar picking out of the bones from among the ashes. That the fire had been lighted on the original surface without paring away the turf was plain enough, from the fact that in paring it immediately below the ashes, at 7 feet 9 inches to 8 feet below the centre picket, the stalks of coarse grass and bracken were very plainly visible in section. But besides this we found also round sections of small stakes about 1 inch in diameter, which penetrated 6 inches or 7 inches down into the natural soil, and some of which tapered towards their lower ends. They had been stuck in to support the pile of wood we may suppose. A chipped flint disc, 2½ inches, chipped on both sides, was found in the centre of the burnt wood, 'Sigwell iii. c,' which might have been used as a sling-stone with a riband sling. Of the other flints some have black fracture surfaces, others have been weathered before being put into the barrow; two good scrapers were amongst them, one, 'Sigwell iii. c,' having been found by us 3 feet 5 inches south-west of the centre, and 4 feet 7 inches below the surface; the other, 'Sigwell iii. f,' having been found by the Rev. A. J. Bennett in superintending the filling-in of the excavation. One flint has a saw-edge, as I think purposely produced; another has the appear-

ance (but not, as I think, the reality) of a barbed arrow-head. Some of the flints had been burnt.

The two bones found at a distance from the burnt ones may nevertheless have belonged to the same body as that which furnished the ashes; both are of the right side, the one an os innominatum, the other a femur fragment. They may have escaped the perfect burning to which the rest of the skeleton was subjected. Why they were not put together with the perfectly burnt bones I do not know. The charcoal and ashes of the pyre must have undergone a very complete sifting to leave so few bones behind amongst them, and also a very complete shifting of place as regards a considerable part of them, for the layer of charcoal over the natural soil, which had been reddened, was not thicker than that which was over the parts which were not so reddened. The charcoal over these latter parts, therefore, must have been removed on to them. That the burnt bones were collected in a skin, or possibly in some textile fabric, and so placed where we found them may, in the absence of any relics of bark, or of either of the other substances just mentioned, be shown to be probable by a reference to a paper by the Babu Rajendralala Mitra, in the 'Journal of the Asiatic Society of Bengal,' 1870, iv. p. 253, where we read that the bones from the pyre 'are washed and put in an urn or tied up in a piece of black antelope skin.'

That the two large fragments of bone found in this interment may very well have belonged to the same body as that which furnished the ashes, is evident from the following observations of Dr. Hutchinson, of Patna, which are put on record by Dr. Norman Chevers, in his 'Medical Jurisprudence,' p. 64, 1870:—

'Dr. Hutchinson, of Patna, an active observer of all that can throw light upon our knowledge of medical jurisprudence in India, took an opportunity to ascertain exactly the amount of wood which would be necessary to destroy entirely an adult healthy body, and the time that would be necessary for its entire cremation. The pyre was composed of ten maunds of wood, but an equal amount of fala straw was necessary, as also two bottles of oil. The pile was lighted at 6·30 P.M., and at 3 A.M. next morning the consumption of the body was declared to be complete. When he visited the spot he found in the centre of the ashes the heads of two femora entire, but completely calcined, and a mass of incinerated matter, as large as two fists, said to be the remains of the liver. Thus 20 maunds, or 1600 lbs. of wood and straw, and two bottles of oil, were required to consume a healthy body, and 8½ hours more required for the operation, which even then was virtually incomplete. Here, however, five times the needful quantity of fuel was consumed.'

APPENDIX ON THE TOPOGRAPHY OF SIGWELL.

BY MAJOR-GENERAL A. LANE FOX.

As it was my particular function during these excavations to make the survey and take the measurements, a few words on the topography of the neighbourhood of Sigwell may be desirable.

Leaving Professor Rolleston to superintend the digging, I set about examining the surroundings. At the distance of a mile in a south-west direction we have Cadbury, a large British camp, which, like most earthworks that are distinctly British, occupies with its entrenchments the whole brow of the hill on which it is situated; it is one of those positions which the Rev. F. Warre, in his excellent classification of the British camps of this district[1], describes as fortresses pure and simple, having no interior divisions, as distinguished from other works which, having a kind of keep and sometimes one or two fortified interior partitions, he considers to be fortified towns rather than positions of a purely military character. It is on a detached spur from the line of hills which are shown on the right of the accompanying rough sketch[2], and which run north and south, forming the eastern boundary of the Yeo Valley, and the source of many of its tributary streams. To the west of Cadbury the ground is low for some distance. On the east, the summit of the hills is occupied by table-land, the margin of which is defined in the sketch[2] by Littleton Hill, Pen Hill, Charnwell, Sigwell, and Gurt, and between this range and Cadbury is the long eastward-stretching valley of Whitcomb, with its central stream rising in Sigwell and joining another stream from the summit of Charnwell, below Cadbury Hill, from which point it flows westward by Sutton Montis and ultimately into the Yeo. Paddock Hill is another detached hill, belonging to this range and situated between Cadbury and Gurt.

The position of the twin-barrow first opened and described by Professor Rolleston on the table-land is shown on the sketch, which it must be observed has no pretension to accurate detail, and is

[1] 'Proceedings of the Somersetshire Archaeological and Natural History Society,' vol. v. p. 38.

[2] This account of the Topography of Sigwell is illustrated in the original paper in the 'Journ. Anth. Inst.' vol. viii. by three plates.

simply an enlargement from the Ordnance one-inch map. Past this tumulus an ancient British roadway runs northward, and turning to the west descends the hill by the steep ravine between the round barrow opened afterwards and Sigwell, and then running along the north-east of the Whitcomb Valley, below the hill and beneath Charnwell, takes the direction of South Cadbury. My attention was first directed to the little spur of Sigwell between the two steep ravines which unite at the six wells or springs from which Sigwell derives its name.

This spur, it soon appeared evident, had been converted into a camp by means of a ditch about 60 feet wide uniting the two ravines. The artificial character of this ditch is shown by its direction forming with the two ravines the base of an equilateral triangle, and therefore being in a position in which it would be impossible that it could have been excavated by water flowing along the ravines from the high ground. The rampart, if it ever had one, has been destroyed, but it is possible the earth from the ditch may have been used to form an interior mound. It would appear that the ditch, as at first drawn, formed too oblique an angle with the northern ravine, and that in order to prevent the position from being taken in reverse by missiles from the high ground on the opposite side, the ditch was afterwards thrown back on that side; this, at least, appears to me the best way of accounting for the mound, composed of undisturbed soil, which has been left in the ditch on the line of the old escarp, and another smaller ditch cut at the back of it; the structure however is peculiar, and may bear a different interpretation. The ditch throughout its length is shallower than the two ravines which form the north and south defences of the triangular interspace; but as the soil is yielding, it is probable that the ravines may have deepened considerably since the place was used for defence, and the enclosed space has probably, by the widening of the ravines at their summit, been much reduced, whereas the ditch not being liable to denudation by water has retained its original depth.

The section running through the tumulus and across the camp shows that the interior of the camp is commanded, at the short bow-shot range of about 120 feet, by the summit of the tumulus. I assume, therefore, that it is unlikely the defenders of the place should have allowed such an erection to be made outside their

camp at the time it was occupied; and as we have proved by excavation that the tumulus belongs to the Bronze Age, it is a reasonable conjecture that the camp was abandoned at some time previous to the termination of the Bronze period. This is confirmed by finding an unusual number of flint-flakes and chips in the interior of the camp—I say unusual because a considerable portion of the neighbouring ploughed lane was searched by the whole party without finding such an accumulation of flakes in any other spot; so abundant were they that we should have no hesitation in pronouncing such an accumulation of chips to mark the site of a small flint implement factory wherever it might be found. This evidence of the antiquity of the camp must be taken for what it is worth. In my judgment, and what is of greater value, in the judgment of Professor Rolleston and those other gentlemen by whom we were accompanied, it is sufficient to make it extremely probable that the camp is at least as early as the Bronze Age, assuming it to be a work of defence, which I see no reason to doubt.

Another hypothesis may be mentioned, viz. that the ditch instead of being a work of defence is simply the continuation of the ancient roadway which, instead of passing down the ravine, ran across the top of the hill, and thus the small trench above mentioned is the way down the eastern ravine; this view, however, is rejected by Professor Rolleston and myself.

We have now to consider the value of this conclusion and its bearing upon the topography of the surrounding neighbourhood. It is seen that this camp at Sigwell commands the six springs beneath it. Charnwell also, on the nearest projecting hillock to the north, had been already recognised as a British camp by the Rev. Mr. Bennett, rector of South Cadbury, to whose knowledge of the antiquities of this district we were indebted on so many occasions. The entrenchment at Charnwell, with its ditch on the outside cutting across the gorge of the hill, is distinctly seen on the east side, the remaining sides being defended by natural declivities, which as usual in British camps are rarely strengthened by embankments, the only exception being in this case at the west end, where the slope is more gentle and where a small rampart, now used as a division to a field, has been thrown up so as to enclose the spring before mentioned, which rises on this hill and joins the Sigwell rivulet beneath Cadbury.

Both these small camps, therefore, covèred springs. Whether there is a camp on Gurt Hill to the south I am unable to say with certainty; my impression is that there was. There has certainly been a low bank with a ditch on the outside across the gorge or narrowest part of the hill, but the greater part of it has been destroyed by a quarry, and there is no spring on this hill that I am aware of. There are also traces of a small bank on Littleton Hill to the north, but not of sufficient extent to afford trustworthy evidence of a defensive work.

Whether there were two or more of these banks, it appears unlikely that such small and feebly-defended camps could have held their own as the strongholds of independent tribes in the vicinity of so large and powerful a fortress as Cadbury, defended by three ramparts and almost precipitous declivities on all sides; and we might therefore assume on *a priori* grounds that they were outposts dependent on the larger fortress. But other and more cogent reasons may be urged in favour of this assumption. The occupiers of Cadbury had flocks and herds, as proved by animal remains discovered in the interior and described first by Mr. Winwood and subsequently by Professor Rolleston. These flocks and herds must have had pasture somewhere. To the west, as I have said before, the great valley is low and swampy, and probably at that time was an impassable jungle. The high, dry, and well-watered Valley of Whitcomb, between the camp and the hills, would be the only place in the neighbourhood where these flocks could be pastured; but with the commanding hills to the east, and the springs arising from them in the hands of an enemy, there could be no security against surprise by hostile neighbours who, approaching unperceived from the tableland, might at any moment make raids upon the cattle from the hills above. The sources of water-supply and the command of the hills must therefore have been a matter of vital concern to the possessors of Cadbury, and the small camps of Sigwell and Charnwell appear to have been thrown up to command the springs and secure an uninterrupted communication with the plateau beyond. From these considerations it would appear that we have here evidence of a central fortress defended on one side, and that the most approachable, by a chain of detached but dependent outposts, which affording as it does some insight into the social condition and military organisation of the inhabitants of this

district at a very remote period, may be regarded as being of some interest to anthropologists. That Cadbury was occupied at a later date than that of which I have been speaking, appears certain from the discovery of horse-shoes and other objects of iron within the camp; but if the evidence afforded by Sigwell camp and the adjoining tumuli is to be relied upon—and I see no reason why it should not be accepted, at least provisionally—the first erection of the fortress and its connection with the neighbouring outposts should date from a period not later than the Bronze Age.

XXII.

DESCRIPTION OF A HUMAN SKELETON FOUND IN A BARROW AT ROCKLEY[1].

Of the skull and bones sent to me from Rockley barrow I have to say that they appear to me to have belonged to a strong man of little if anything above 5 feet 5 inches in stature, and considerably past the middle period of life. He had suffered a good deal from the rheumatic exostosis which so commonly plagued the former inhabitants of this country in every grade of life; but on the other hand he appears to have retained his full adult complement of thirty-two teeth to the time of death. It is possible that out of some two or three sockets now filled with earth the teeth may have dropped out a short time before the death of their owner; it can, however, have been only a short time, as the sockets are but little absorbed. The teeth are very much worn, in some cases to below the level of the enamel; but there is no indication, except in one case, of any alveolar abscess having followed upon this severe tare and tret. In an ill-fed subject the case would have been very different, as Mr. Mummery has shown in his paper on 'Dental Caries,' in the 'Transactions of the Odontological Society of Great Britain,' November, 1869, vol. ii. pp. 47, 51, 54, 60, 63.

As regards the affinities of the owner of the skull, I should, if allowed to speculate upon the evidence furnished by the osteological remains only, say that we have here one of the hybrids produced by the intercrossing of the tall brachycephalic bronze folk with the short but dolichocephalic race of the long barrow—and stone with

[1] [In August 1879, the Wiltshire Archaeological and Natural History Society were present at the opening of an early British bowl-shaped barrow, on the estate of W. H. Tanner, Esq., of Rockley. An account of the opening was given by H. Cunnington, Esq., in the Proceedings of the Society, and the skeleton was described by Professor Rolleston.—Editor.]

bone implement—period. For the characters both of skull and skeleton are intermediate between those of these two sets of men. The short stature, the lowness of skull as well as of stature, and the orthognathous character of the jaw, albeit a little exaggerated by senile absorption, point to the earlier stock; whilst the strength of the bones, skeletal and cranial both, and the brachycephalic character itself, incline us to the other view. The hypothesis of crossing will cover and combine the facts. I should be slow, in default of other evidence besides that which is furnished by the osteological remains, to aver positively that this skull must have belonged to a man of the Bronze period. The comparatively perfect condition of the teeth is, however, certainly in favour of the claims of the former period, according to Mr. Mummery's examination of Dr. Thurnam's collection[1], in which amongst sixty-eight long-barrow skulls only two cases of decay were found, whilst amongst thirty-two of the later period no less than seven such cases were found.

As individual peculiarities, the exceedingly low orbital index is specially noteworthy, though some doubt may exist as to its ethnological significance. Correlated with a comparatively full lower jaw we have a comparatively vertical forehead; the strength of the ridges, on the other hand, overhanging the orbits, and above all, the strength indicated by the temporal and other ridges for muscular insertion on the back parts of the skull contrast rather than correspond with the weakness of the upper jaw. Something of this last peculiarity, however, is due I think to senile atrophy, which would have progressed further but for the persistence of the teeth in their somewhat wasted sockets.

Rheumatic exostosis had beset both vertebrae and long bones, and had not spared the articular condyles of the lower jaw; impairing thus the happiness, or at any rate the enjoyment, of their owner very considerably.

The sutures of the skull are still unobliterated on the outer surface at least of the skull; this point Dr. Thurnam would have held, I think, to be more common among the brachycephali of the Bronze than among the dolichocephali of the Stone age. But it may have been an individual peculiarity, and so may be taken to point neither

[1] For a discussion on this point see 'British Barrows,' p. 701; also Article XVI. p. 302.

way. A peculiarity—rare, I think, in ancient skeletons—is noticeable here; the clavicles are those of a left-handed man; the right humerus being, however, longer considerably than the somewhat more roughly marked left one.

Measurements of Skull and Long Bones of Skeleton from Rockley Barrow.

Circumference	21·3	Alveolar index	·90
Length	7·45*	Nasal height	2·1
Breadth	5·75	Nasal width	1·1
Length-breadth index	·80	Nasal index	·52
Height	5·55	Orbital width	1·8
Length-height index	·76	Orbital height	1·3
Basi-nasal length	4·35	Orbital index	·75
Basi-alveolar length	4·		

Cubic capacity = 95 cubic inches.

Length of femur	17·9	Width of ascending ramus	1·5
Length of right humerus	13·2	Height of articular process	2·1
Length of left humerus	12·7	Height of coronoid process	2·15
Depth of lower jaw at symphysis	1·25		

XXIII.

REPORT ON THE FAUNA OF A CRANNOG AT LOCHLEE, TARBOLTON, AYRSHIRE[1].

Among the bones submitted to me by Robert Munro, M.D., Kilmarnock, and reported as having been procured from a Crannog at Lochlee, the following animals have their skeletons represented:—

The ox, *Bos longifrons*.—No proof of the presence of the wild variety.

The pig, *Sus scrofa*, variety *domestica*.—I am not clear that the wild variety is represented here any more than in the specimens of the preceding species. (One fragment might have belonged to a wild individual, the molar No. 3 in it having all the pinnacles and eminences which have given to the teeth of the *Suidae*, as to the whole division of non-ruminant Ariodactyles, the name Bunodont, worn away, and having its grinding surface consequently reduced to one single, however sinuous, continent of dentine bounded by enamel.) As is well known[2], the bones of an ill-tended and ill-fed, self-providing, so-called domestic pig, come to be very like the bones of a thoroughly wild pig; whilst, on the other hand, it is also well known that very great variations exist as to size within the limits even of the wild varieties of *Sus scrofa*. But in the series now before me there is only one fragment, consisting of the part of the lower jaw which carries the last molar,

[1] [In 1878 a Crannog at Lochlee was excavated and a description was given by Dr. Robert Munro to the Society of Antiquaries in Scotland, and published in their Proceedings, 1880. The Report on the animal remains found in the course of the excavations was furnished by Professor Rolleston.—Editor.]

[2] See Nathusius, 'Schweineschädel,' 1864, p. 147; Rütimeyer, 'Basel Gesell. Naturforscher,' 1864, p. 161; Naumann, 'Archiv für Anthrop.,' viii. p. 23, 1875; Stüder, 'Zürich Mittheilung Pfahlbauten,' 1876, xix. 3, p. 67.

and a part of the ascending ramus and of that last molar itself, which could, I think, by any possibility be referred to the wild variety. And even here such a reference could only be justified on the ground of the great degradation which the cusps of the tooth have suffered, it being usually the case that domestic pigs are not allowed to live sufficiently long to get their teeth so worn down. I have however to say that, both from this country and from India, skulls of undoubtedly domestic animals of this species have come into my hands, in which the teeth are worn down far below the limits to which the molars of pigs are allowed to be worn down by modern model-farm managers.

The texture of the bone furnishes us with no indications, its gloss and tenacity, if such it ever possessed, having been entirely removed by its long-maceration in water.

It is however worth mentioning that this fragment from a Scottish Crannog exactly reproduces the contour of a fragment from the Starnberger See. (See memoir on this 'find' in the 'Archiv für Anthropologie,' viii. 1875.) In both the angle of the jaw has been knocked away, for the sake, doubtless, of the soft and succulent, and I may add sensitive, substances it protected during life; and in both the posterior molar has been left *in situ*, though much worn down. The posterior molar however of the foreign specimen has that superior development of its third molar, which, if Nathusius ('Schweineschädel,' p. 49) had not taught us better, might have been referred to domestication instead of to better food or sexual (male) character. I owe this specimen to the kindness of J. E. Lee, Esq., F.G.S., and though I hesitate in the case of the Scottish specimen, I have no hesitation in referring this one to the wild variety, as indeed it is referred under the title *Sus scrofa ferox* on the label it carried when it came into my hands.

The specimens of pigs' bones and of pigs' teeth are numerous, but none other either of the bones or of the teeth are of the size, strength, or proportions which would have enabled their owners to hold their own as wild animals in a country in which the wolf may still have existed [1].

The sheep, old dun-faced breed, *Ovis aries*, variety *brachyura*.—

[1] For reference to the bibliography of Prehistoric Swine, see 'Linnean Soc. Trans.,' ser. ii., Zool. vol. i. 1877, p. 272; also Article XXX. p. 547.

One nearly perfect skull of a sheep of the variety which is known as *brachyura*[1], from having a short tail, but which also has the horns of the goat, set on, it is true, with their long axis at a different angle from that which they have in the true goat, but still in themselves of very much the same shape. One lower jaw in this series has the concave posterior boundary, and the sinuosity anterior to its angle which goats usually, and sheep only sometimes possess. It belonged however to an immature individual, the posterior molar not having been evolved, and it cannot be considered to positively prove the presence here of *Capra hircus*.

The red deer (*Cervus elaphus*) is very abundantly represented in this series, especially by fragments of horns, some of which bear marks of having themselves been cut and sawn by other implements, whilst one or two may possibly have been used, as the tynes of red deer so often were by the early British flint-miners, as borers.

The roe deer (*Cervus capreolus*) is only scantily, though unambiguously, represented in the collection from Lochlee.

The horse (*Equus caballus*) is represented by but a single shoulder blade; it is of small dimensions relatively to most or all domestic breeds with which I am acquainted; this applies however to all the domestic animal remains found here.

Rein-deer (*Cervus tarandus*).—There are two more or less fragmentary portions of horns which, after a good deal of comparison with other rein-deer horns, and with fragments of red-deer horns, I incline to set down as indicating the presence of the former animal in this collection. It is easy to separate rein-deer horns from red-deer horns when you have the entire antler before you, or even when you have the brow antler only, in most cases; and it is usually easy to separate even a fragment, if the fragment is fresh, because the surfaces of these two horns are different. But here the two fragmentary horns in question have no brow antler left, and their surfaces have been macerated so long as to have desquamated, or, to change from a medical to a geological metaphor, have been denuded a good deal. Still, one fragment is, I think, too tabular, and the other is too tabular also, and that just below the origin of what

[1] For reference to the history of this variety of Sheep, see 'British Barrows,' p. 740; also Article XVII. p. 341.

in the red-deer is known as the sur-royal antler, to be anything but a rein-deer's.

Writing for Scottish readers, I need not refer to Dr. J. A. Smith's paper 'On Remains of the Reindeer in Scotland,' read before the Society of the Antiquaries of Scotland, June 14, 1869, vol. viii. pt. i. pp. 186–223, nor to his references in that exhaustive memoir to preceding writers. But I may mention an additional reference which Dr. J. A. Smith—not being gifted with as much second-sight as he is with insight—could not have then referred to, as it is contained in a book of more recent date than is his paper. This reference will be found in Dr. Joseph Anderson's edition of the 'Orkneyinga Saga,' chap. vi. p. 182.

Regarding a subsequent consignment of bones and horns sent to Professor Rolleston, he writes as follows:—

The only remark which I feel called upon to make relates to the bones and the teeth of the pig; the marrow cavity in the lower jaw of one of the pigs, a young specimen, containing a large quantity of crystals, and the teeth of the older pigs showing a great deal of wear for the teeth of what were, I think, domesticated swine. The crystals were analysed by W. W. Fisher, Esq., of the Chemical Department in the Oxford Museum, and found to be vivianite, as supposed. It is not uncommon to have bones from prehistoric 'finds' which have been much acted on either by fire or water, thus coloured by double decomposition of the bone phosphate with some iron salt furnished either from the bone and flesh or otherwise.

The horns (all the washed ones in the collection) received a few days ago are all of red-deer (*Cervus elaphus*) except one, which is of *Cervus capreolus*. With this consignment came one bone, or rather the ulna and radius of a *Bos longifrons* more or less fused into one bone. The horn of the roe is rather a large one.

XXIV.

REPORT ON BONES FROM CHASTLETON[1].

I WAS reluctantly obliged to decline to join the excursion to Chastleton, but I have been favoured with a small box of bones from that pleasant place, of which I will now say a few words.

All the bones, with two or three exceptions, are bones of domestic animals. The exceptions are constituted by two lower jaws and one upper jaw of the water rat, *Arvicola amphibius*. These jaws have a certain interest, as they are just the parts which the polecat, *Mustela putorius*, leaves behind—and rightly, as the large rootless molars and the strong incisors of this harmless vegetable-feeding rodent would be a hard thing for his sharp scissorlike teeth. I have found large quantities of these jaws, handfuls in fact, and without exaggeration, in the lairs of polecats. The polecat is a river-haunting riparian animal, but will carry even frogs a long distance away from the marshy places he finds them in.

Sus scrofa, varietas *domestica*, is represented by a few incisors. The pig, being a beast familiar to man from the very earliest times, as his solidarity with man in supporting the life-phases of more than one Entozoon shows, is rarely absent from the earliest prehistoric finds of Neolithic times.

The cow, *Bos* (probably) *longifrons*, is also represented, but scantily.

The sheep, *Ovis aries*, or the goat (there are no differentiating parts

[1] [These bones were obtained during excavations conducted under the direction of E. W. Brabrook, F.S.A., Alfred White, F.S.A., and J. E. Price, F.S.A., in the camp at Chastleton, Moreton-in-Marsh, on the confines of Oxfordshire, Gloucestershire, and Worcestershire. Mr. Price states, in the 'Journal of the Anthropological Institute,' vol. x. p. 125, 1881, that the excavations proved the whole of the camp to be of Roman construction. 'There is nothing in the objects found to illustrate a period either earlier or later than the Roman occupation.'—EDITOR.]

left) is also proved to have been in existence and in availability for man's use by a larger quantity of bones and some teeth.

The horse, *Equus caballus*, of small size, or possibly *Equus asinus* (for I have no means of ascertaining the age of these bones, nor of saying whether they did or did not belong to those 'far-off times' when 'our land did breed no asses'), is represented by a single *Os calcis*.

There are no human bones, nor canine, nor feline in this series, but the bones are so broken as to prove they were '*mauled*' by man for his *maw*, and some look as if they might have been mumbled or gnawed by the dog for his. With these came one of those darning-needle-like awls, made out of the long bone, *tibia*, of a small ruminant, possibly roe, *Cervus capreolus*, but also possibly sheep or goat. I get them from many places in this neighbourhood, of many stages in the development of the world's history. They would make good packing-needles nowadays. I do not see why these bones should not be, as far as any indications they themselves furnish—and I have no other before me of any age—not nearer to us than some 500 years or so.

XXV.

ON THE CRANIOLOGY OF THE BUSHMEN.

The following human bones—viz. four skulls, six lower jaws, four cervical vertebrae, one large and one small sized scapula, two small sized and fragmentary humeri, a fragment of a very slight but adult ulna, four cervical vertebrae, and five more or less fragmentary ribs—have been put into my hands by Mr. C. G. Oates, with information to the effect that they had belonged probably to a Bushman horde massacred somewhere between the Tati and Ramaqueban rivers, in S. lat. 20° 54′, and long. 27° 42′. With these human bones came some bones of *Equus* (*caballus* or zebra?); also of one large ruminant (*Bos taurus* or *Bos caffer*), and one smaller; and part of the skull of an ostrich (*Struthio camelus*); and, later, the feet-bones of an elephant (*Elephas africanus*). All these bones had been collected by my former pupil, Mr. Frank Oates, of Christ Church, Oxford. The four skulls had not their lower jaws assigned to them; but to three of them jaws were assignable, which in all probability had really belonged to them, being very exactly coadaptable, to say nothing of their having been sent in company with them and with certain cervical vertebrae. These six lower jaws are by far the most important bones as regards the question of the nationality of the entire 'find.' If, indeed, these half-dozen lower jaws had been brought to me with no other accompaniments and with no other information than that they had been all brought from one spot in Africa, I think I should have been justified in saying that they had belonged to no other known African race than the Khoi-Khoin, or its central African representative, the Akka. For they all six alike show the following distinctive and eminently significant peculiarities—viz. lowness of coronoid process, smallness of absolute size, and all but complete obsolescence of chin. Upon

this I have already commented in 'British Barrows,' pp. 706, note 1, 707, 716[1], *ibique citata*, comparing these lower jaws with the jaws of certain other confessedly 'priscan' races, which differ from them in little but in being larger in size. It is, or should be, a commonplace among craniographers that, whilst the lower jaw is a more important bone for their purposes than any other single bone of the skeleton, and even than the pelvis itself, it is often more distinctive, if not more valuable, than at least the entire *calvaria*. Certainly this is the case with African skulls; for though it is possible enough, as was long ago pointed out by Professor Owen (see 'Osteological Catalogue, Royal College of Surgeons of England,' 5385, p. 838, 1853; and, for a contradictory statement, Retzius, 'Ethnol. Schriften,' 1864, p. 149), and has recently been reaffirmed by Dr. Hamy in Paris, to find brachycephalic skulls among those of undoubted Negro races, and though, as I can aver from my knowledge of the collections in the Oxford University Museum, it is by no means always possible to distinguish either such brachycephalic Negro skulls, or certain other Negro skulls of the dolichocephalic type more usual amongst such skulls, from Bushman skulls of the respective proportions, both of which are represented in this latter series, it is within my knowledge always possible to do this if the skulls under comparison are in possession of the lower jaws belonging to them. The Negro's lower jaw may or may not have the poorly-developed chin so constant in the lower jaws of the Bushman, and but rarely seen in the lower jaws of higher races; it may or may not have its anterior teeth sloping forwards in correlation with a prognathic upper jaw; it may or may not, I apprehend, though I have not met with such cases, be as a whole as small and feeble as the jaws of the Bushman have, to my knowledge, invariably been; but it never has shown, so far as I know, the low coronoid process, the shallow sigmoid notch, and the wide ramus so very commonly, or indeed all but invariably, found amongst not only the Bushman but the Eskimo race. The existence of this peculiarity not only in these two races so widely separated in space, though so nearly on a level in certain linguistic as well as certain other points of degradation, but also in so many of the lower jaws of the earliest representatives of our species, gives it a great morphological importance; and this morphological importance is not

[1] See Article XVI. pp. 308 et seq. of this volume.

a little enhanced when we consider a second fact, drawn from a wholly alien line of contemplation, that, namely, which shows us that teleological adaptation to special needs, or necessities rather, as to dealing with food, has nothing to do with it. The fact of six lower jaws all alike exhibiting this striking peculiarity, which may be shortly described by saying that it resembles the conformation seen in the Gibbon, whilst the larger anthropoid apes show the coronoid developed into a prominence which comes much more nearly into resemblance with that usual in our own species, is to my mind very strong evidence to the effect that we have here six Bushman jaws before us. In all of these lower jaws we find the angle roughened and projecting outwards in correspondence with the insertion of fibres of the masseter, and thereby giving a greater width to the lower portion of the face; whilst, internally, the surface below the inferior dental foramen is remarkably concave, owing in some cases to a general though slight inversion of the lower portion of the ramus, and in others to a thinning of the bone in the region between the alveolar process, in the region of the last molar, and the angle thickened at once by the insertions of the masseter and of the pterygoid. Of the four skulls one only fails to find a lower jaw which will in any way admit of coadaptation to it, and this skull being exaggeratedly dolichocephalous as well as of much larger size and proportions than the other three, may very well be supposed to have belonged to one of the attacking and not to one of the attacked tribe; for I apprehend that in massacres, at least of Bushmen, the killing is not usually all on one side. The 'reports,' indeed, both of their enemies and of their friends, assure us that a Bushman at bay is a foe by no means to be despised, and that, though little, he is fierce. And I can say for those three crania that their *tout ensemble*, as compared with that of Abantu skulls placed alongside of them, impresses me with the same kind of feeling which after detailed measurements I have felt in comparing the crania of Lapps with those of races such as the Finns living close to them. They appear to me, in fact, to indicate that their owners were of a smaller race than the owners of the skulls beside them, though the Bushman is not always a mere dwarf, as is sometimes stated. The feebleness of the two humeri, and even more notably of the fragment of ulna, and the small size of the cervical vertebrae and of one of the two scapulae accompanying

these bones, tell in the same direction, but do not prove feebleness of mind.

For purposes of comparison with these three presumably Bushman crania, I have had three other crania at hand from the University Museum, of the genuineness of which there can be little doubt. One of these was presented to the University Museum by the late and much-lamented Dr. W. H. J. Bleek, to whose labours[1] in elucidating the language and rescuing the folklore of the Bushman tribe from perishing we owe so much. This skull, which was brought to England by Mr. Alfred Hughes of St. Asaph, bears a label, 'Eland's Been, nr. Schietfontein[2], Bushman's skull,' and was handed over to me by that gentleman at the desire of Dr. Bleek. A second skull came into my hands through the kindness of W. G. Marshall, Esq., of Colney Hatch, having been entrusted to him by George Dunsterville, Esq., of Port Elizabeth, Algoa Bay, S. Africa, who was for some years surgeon to the hospital at Port Elizabeth. This skull, which, like the preceding, belonged to an exceedingly old man, carries the following labels:—'From the Transvaal, S. African Republic;' 'Of an original Bosjesman, a tribe of small Hottentots, now nearly extinct; over age; height, 4 ft. 4 in.'[3] The evidence for the authenticity of the third Bushman cranium, which was in the University Museum previously to the arrival of Mr. Oates's consignment, is even more irrefragable. This cranium was procured for the University through the kindness of H. N. Moseley, Esq., F.R.S., from Mr. Fairclough of Cape Town, and with the cranium came a knife, a poison-pot, a quiver, a poisoned arrow, and an ivory wrist-protector which had belonged to the owner of the skull. This skull belonged to a man past the middle period of life, and is remarkable for its absolute height, no

[1] See his two Reports concerning his Researches into the Bushman Language and Customs and Folklore, presented to both Houses of Parliament of the Cape of Good Hope, by command of his Excellency the Governor, 1873 and 1875, and 'Journal of the Anthropological Institute,' 1871.

[2] [The name of the locality from which this skull came had been misread in the original article. Mr. C. G. Oates suggested to me that it was perhaps Eland's Been, near Schietfontein, in the District of Carnarvon, Cape Colony. The accuracy of this suggestion has been confirmed by Mr. W. Hatchett Jackson, who has kindly re-examined the label. I have accordingly corrected it in the text.—EDITOR]

[3] [Mr. Hatchett Jackson informs me that the skull presented by Mr. Dunsterville was marked 'female' on the label and that it is the counterpart of the skull presented by Dr. Bleek, whilst the skull given by Mr. Fairclough was known to be male.—EDITOR.]

less han 5·4 in. which, however, falls short of its absolute width, which is no less than 5·6 in., by which inferiority the tapeinocephalic or platycephalic character which Mr. Busk ('Journal Ethn. Soc.' London, Jan. 1871) insisted upon as existing in Bushman crania is preserved in it as well as in the two other crania just specified.

Retzius, in a paper first published in Swedish in 1856, subsequently in German in Müller's 'Archiv' for 1858, and fully republished in the posthumously issued (1864) 'Ethnologische Schriften,' p. 149, after saying that he had before him only a single skull of a Hottentot, and the figures which Blumenbach and Sandifort had published of Hottentot and Bushman crania, declares himself unable to detect any essential difference between such skulls and those of true Negroes. His great authority therefore should not be quoted to the disfavour of craniological evidence in this or any other similar question, inasmuch as he only speaks, and avowedly, from very scanty materials.

If we begin our comparison of these two sets of crania by a reference to the great distinction, pointed out by Retzius himself, of brachycephalic from dolichocephalic crania, we have in the first place to demur to the statement, 'In Afrika, fehlt, so viel man bisher weiss, jedes Spur brachycephalischer Bevölkerung.' Against it have to be set in the first place Professor Owen's words in the old 'Osteological Catalogue,' 1853, p. 838, 5385, already referred to; and in the second, Professor Flower's measurements (as recorded in the new 'Catalogue of the Specimens illustrating the Osteology and Dentition of Vertebrated Animals,' pt. i. 1879, p. 232, 1238) of the 'articulated skeleton of a Negress, born in the United States of North America, and about 16 years of age,' who was said, presumably by the donor, Professor L. J. Sandford of Yale College, 'to have presented all the external characters indicating purity of race,' the cephalic or latitudinal index of the cranium belonging to this skeleton being no less than ·811. But though this be so, there is no doubt, firstly, that the immense majority of Negro and of Caffre and Abantu crania are dolichocephalic, and some—such for example as the Mozambique skull, casts of which were given by the late J. South, Esq., F.R.S., to many museums—exaggeratedly so; and secondly, that the cephalic index of the Bushman is considerably higher on the average than that of the Negro. One of my six Bushman crania (that named No. 1, Mr. F. Oates, 788*e*)

has a cephalic index of ·81, being equal to that of the Negro girl just mentioned in the College of Surgeons' Museum; and though one of the six has but ·70 for its cephalic index, still the average of the six is as much as ·75, and Professor Flower's six give us an average of ·768 as against one of ·731 for the circumambient 'Zulus and Kaffirs,' and against one of ·736 for 'African Negroes of various tribes.'

The altitudinal index is as significant as, if not more significant than, the latitudinal; and the tapeinocephalic or platycephalic character of the Bushman as compared with the two other assemblages of Africans just mentioned, is expressed by the figures ·716, as against altitudinal indices for them of ·741 and ·735 respectively. The average of the altitudinal indices of my six Bushman crania is ·72, the height exceeding the breadth in two cases only, and in each of them by one-tenth of an inch only.

As important a question to ask about a skull as either of the two relating to the two indices just mentioned, is, to my thinking, the question, does the cranium when resting, in the absence of its lower jaw, with the grinding surfaces of its teeth on a flat surface, touch that surface posteriorly with its occipital condyles, or with its inferior occipital squamae? Accordingly as the former or the latter portions of the occipital bone give support posteriorly to a skull so placed, is the cranial curvature lesser or greater, and with it the antero-posterior arc described by the brain it contains. Tried by this test, first suggested by Prof. Ecker ('Archiv für Anthrop.' iv. 1870, p. 288), the six Bushman crania in the museum whence I write have four of their number resting on the occipital squamae, as opposed to two which show the lesser curvature. I incline to think that this is a higher average than West Coast Negro crania would show, but Abantu skulls are very frequently so well developed as to have a considerable interval left between their occipital condyles and a flat surface, touching anteriorly the grinding surface of their teeth, and posteriorly their *conceptacula cerebelli*.

Another important point given us in that most instructive of *normae*, the *norma lateralis*, is that of the junction or non-junction of the squamous to the frontal. This question is easily answered, as in no single one of my six Bushman crania does the squamous approximate itself at all more closely to the frontal than it would do in an equal number of European crania. Indeed, in all but one of these

crania the alisphenoid is wide from before backwards, as though to furnish adequate lodgment for the temporo-sphenoidal lobe of the cerebrum, which we know, alike from Gratiolet ('Mémoire sur les Plis Cérébraux,' p. 97) and Professor John Marshall ('Phil. Trans.' MDCCCLXIV, p. 510), to take a large development in the Bushman race[1].

I have in the next place to draw attention to a striking qualitative or morphological peculiarity observable in no less than three out of my six Bushman crania; this being the presence either of a perfect, or of a rudimentary division of the malar bone into two distinct parts. The skull presented by Dr. Bleek presents us with a perfect rectangular suture, bilaterally symmetrical, as is usually the case with this suture both when it is and when it is, as here, not, rudimentary. In the two skulls 788*e* and 788*g*, collected by Mr. Frank Oates, the suture is rudimentary, being represented in each skull by a bilaterally symmetrical fissure running horizontally forwards from the zygomatico-malar articulation[2]. When I add to these observations the fact that similar sutures have not within my knowledge and research been observed in other African crania of any of the varieties living on that continent, it will be seen that the presence of them in these skulls goes a considerable way, when coupled with other considerations, towards making it pretty certain that they were of Bushman nationality. Further investigation of the distribution and non-distribution of this most significant suture amongst the several typical races of men lends some additional force to this argument, and is besides not a little suggestive as to other views. In the Oxford University collection of crania I have not found any traces of it amongst forty-seven Australian, nor amongst our five Tasmanian crania, nor amongst our Stone-age

[1] For the relation of the alisphenoid, squamous, and frontal, see Broca, 'Instructions Craniologiques,' pp. 26, 27, 1875; and Gruber, 'Ueber die Verbindung der Schläfenbeinschuppe mit dem Stirnbein,' 'Mém. de l'Académie Impériale des Sciences de St. Pétersbourg,' tom. xxi. no. 5, 1874. Hermann Schlocker, 'Ueber die Anomalieen des Pterion;' Inaugural-Dissertation zur Univ. Dorpat, 1879.

It is right, however, to add that the skull of the Bushwoman whose brain Professor Marshall has described, *l.c.*, had the squamous of the left side joined to the frontal, and that with obliteration of the suture; and that though Dr. Williamson has not recorded the presence of this junction in any of the three Bushman crania described by him in his 'Catalogue of the Army Medical Museum,' 1867, he has noted it in two out of the seven skulls of the closely affined Hottentot race.

[2] Similarly rudimentary sutures are observable in several of the Bushman crania in the Royal College of Surgeons of London.

crania, a series well represented here. The only other race of indisputably pristine and very pristine habits, in which I have observed it to exist, is the Eskimo, and out of a large number of such skulls I have only noted it once, in the form of bilaterally symmetrical fissure. The other skulls which this Museum contains possessing this suture either well or rudimentarily developed, are six in number. Four are presumably either of the Malay or of the Chinese race, as two were collected by Captain Elmhirst of the 9th Regiment, from the sea-shore of an island in the Chinese Seas, out of a great quantity which were lying about unburied, and were supposed to have belonged to Chinese pirates, and were finally presented to the University Museum by the Rev. H. Hansell, Fellow of Magdalen College; the third was a skull of a female Moro, collected in the mountains of Sulu, and presented by Captain Chimmo, R.N.; whilst the fourth was purchased from Mr. Cutter, the dealer in Natural History specimens, as being a Borneo pirate. The other two are from Ceylon, one being a Tamil from Central Ceylon, presented by Mr. B. F. Hartshorne, who was himself for a considerable time resident in the island, and has written upon its ethnology; the other being a 'Malabar.' As the absence of this suture from the Zulu and Negro series gives additional importance to its presence in the Bushman, so its absence, which I have noted in a considerable number of Praearyan skulls, such as those of the Coles and Moosahurs, procured for me by William Duthoit, Esq., D.C.L., gives additional importance to its presence in 'Malabars,' 'Tamils,' Malays and Chinese. Of course further research may discover this suture in other races of mankind; as the matter stands at present I am tempted to think that there is possibly some significance in its having been noticed in the Eskimo, in the Bushman, in certain races of the Eastern Archipelago, and in Tamil skulls, as well as in the fact of its having been found to be absent in certain other skulls also of ancient races, such as the Kolarian and the Australian [1].

[1] It may be well here to give the literature of the *Os* (*Malare*) *bipartitum*:—

1779. E. Sandifort, 'Observat. Anat. Path.' lib. iii. 113; tab. viii. fig. 7.

1837. 'Leçons d'Anatomie Comparée,' par Georges Cuvier et M. Duméril. Seconde édition, par F. G. Cuvier et Laurillard, tome ii. p. 381, 1837.

1844. Breschet, 'Ann. Sciences Nat.' 3 sér. Zoologie, tome i. p. 30.

1852. Schultz in 'Bemerkungen über den Bau der normalen Menschenschädel,' p. 57, tab. ii.

The main sutures I think have perhaps something peculiar about them, this consisting in their being made of denticulations which are complex but shallow, contrasting thus with the complex but deep denticulations of well-developed European, and the coarse but shallow ones of Australian crania.

The verticality of the forehead observable in so many Bushman, and, indeed, in so many other African crania, is correlated with the comparative feebleness, and consequent lightness, of their lower jaws, which renders it unnecessary[1] that the brain and brain case should be rotated backwards to counterbalance the facial skeleton and to maintain the visual axis in a horizontal or semi-horizontal plane.

I have appended to this paper the measurements given by Professor Flower, in his recently issued (1879) Catalogue, of the six Bushman crania in the College of Surgeons' Museum, pp. 246, 247, and also the same measurements, as taken by myself, of the six Bushman crania in the Oxford University Museum. The very close correspondence of the two sets of measurements will strike any one who will compare the columns which give the averages of the two sets. The fact may be expressed in technical language by saying that both lists coincide pretty nearly in showing that, as

1867. Canestrini, 'Annuario della Soc. dei Naturalisti in Modena,' 1867, p. 83. 'Gazzetta della Cliniche,' Torino, 1871. G. Delorenzie's 'Tre nuove case d'anomalia dell' osso Malare,' Torino, 1872. E. Marselli, 'Sopra una rara anomalia dell' osso Malare,' Modena, 1872.

1873. Gruber, 'Monographie des zweigetheilten Jochbeines bei Menschen und Säugethieren,' Archiv. Anat. und Physiologie, p. 337.

1874. Gruber, 'Ann. Sci. Nat.' 3 ser. Zoologie, tome i. p. 30.

1878. 'Human Osteology,' Holden and Doran, p. 99.

Laurillard's words from Cuvier's 'Anatomie Comparée,' vol. ii. pp. 381, 2, are specially worthy of being quoted, as they were published so long ago as 1837. They are as follows:—

'Au bord inférieur du jugal nous avons trouvé sur deux sujets un os particulier, alongé et aplati, étendu tout le long du bord inférieur du jugal, et l'articulant en avant avec l'extremité très-saillante de l'apophyse malaire du maxillaire et en arrière avec l'apophyse zygomatique du temporal, laquelle se trouve ainsi présenter deux sutures, l'une verticale avec le jugal proprement dit, l'autre horizontale avec ce second jugal en faisant un angle presque droit avec la précédente. Dans les sujets où nous l'avons rencontré, la forme de ce nouvel os, ses connexions avec les os voisins, sa proportion avec l'os malaire proprement dit, étaient les mêmes, et comme nous avons trouvé, ainsi que nous le dirons plus loin, dans certaines espèces de singes une subdivision parfaitement semblable, nous sommes portés à la considérer autrement que comme une disposition purement accidentelle.'

[1] See Cleland, 'Phil. Trans.' 1870, p. 163.

Professor Flower has phrased it at p. 255, l.c., the Bushman cranium is 'mesaticephalic,' 'orthognathous' (or, at least, mesognathous, my average being 98, which is 'mesognathous,' as against Professor Flower's 97·8, which is just below the limits of mesognathy), 'platyrrhine,' 'microseme,' and 'microcephalic.'

By a comparison of my measurements, not with those of Professor Flower, but with my own records of the history of each skull, an even more surprising and more important fact, in the way, however, not of coincidence but of the reverse, is brought to light. The most aberrant of the six in the matter of measurements is the very skull about the authenticity of which there is the most perfect certainty. This is the skull presented by Mr. Fairclough, with which were sent the articles specified above, as characteristic of the Bushman race. But the skull itself is, in almost every important particular, different from the five other crania here measured with it. Its circumference and cubical capacity, its length, breadth, and height, and their indices, its orbital and nasal indices, are all alike aberrant from the average. It certainly would not have entered into the head of any craniographer to refer this skull to the Bushman variety of our species, unless he had been informed of the character of its accompaniments. A morphological point which might have served to indicate the character of its owner—I mean the feebleness of the nasal spine, a shortcoming more or less evident in all, or nearly all, Bushman crania—does not help us here; for we observe in this skull that the line of symphysis of the two halves of the upper jaw rises here anteriorly, as it does sometimes in European jaws, into a raised double ridge, which, though it slopes gradually into the plane of the alveolar border, and does not rise into a sharply-defined angular spine, and so far falls short of the typical 'anterior nasal spine,' is yet a very different thing from the very feebly-developed bifid process of ordinary Bushmen, and many other African and other savage jaws.

The question arises, how are we to interpret these facts? We may explain them by saying that the elasticity and plasticity of the type is such as to admit of the escape of an exceedingly aberrant individual, and its homogeneity and plasticity nevertheless also such as to allow of its walls joining again, and restoring the perfect circumscription which is implied in our speaking of the

race as possessing well-defined limits. Or lovers of logical consistency, who may not be extensively acquainted with the width over which variability may extend itself, may prefer to suggest that some kind of error may attach or have been attached to the identification of this particular cranium. It is possible, I suppose, that a runaway Caffre, or even an outcast white man, may have betaken himself to some horde of Bushmen, and identified himself with their manners and customs, and adopted their dress and equipment. Such voluntary degradations are known to have taken place, with the consequence of the refugee becoming not merely 'half a savage,' but rather, as shown by the place and precedence given to him, 'a savage and a half;' or, finally, the owner of this skull may really have been a cross between a white man and a female of the Bushman stock. To this last explanation I myself incline.

As regards the condition of the teeth, the skull presented by Mr. Fairclough, though referred by me to a man in the middle period of life, has only some seven or eight teeth, comparatively little worn, left *in situ;* the rest having been lost, and traces of two or three large alveolar abscesses and great absorption elsewhere of the alveolar processes are very evident. Alveolar abscesses have similarly left their traces in the skull presented by Dr. Bleek, in which, however, the teeth have been very much worn down, though only one or two have been lost during life. The skull presented by Mr. Dunsterville had lost all its teeth, save the two central incisors, during life, and the alveolar processes have suffered a very large amount of absorption in this senile skull.

Of the entire series, as the figures giving the length of the circumference and the cubic capacity show most plainly, we can predicate smallness; the average of the latter measurement being but 1285 as against 1485 cub. cent. obtained by Professor Flower for the cubage of seven Caffres and Zulus, and, indeed, as against 1330 from his measurement of his available Bushman crania.

With this small capacity is combined, which is by no means always the case in crania of races low in the scale of human life, a short basi-cranial axis, with an average length of no more than 93 millimetres.

In none of these six skulls is the patency of the frontal suture,

which corresponds very usually to a wide receptacle for the frontal lobes of the brain, observable. On the other hand, the zygomata do not come into view, when the skull is held out so as to present its norma verticalis at arm's length to one eye of the observer, with the invariability which might have been expected. In two only of these six skulls are both zygomata seen at the same time when the skull is held in this position; in three the zygoma of the left side only is seen; and in one neither zygoma comes into view. But these skulls, as is often the case in skulls of flesh-eating savage races, are of considerable density, and a greater thickness of walls as well as a greater development of the contents of a skull may prevent it from being phaenozygous. One other condition indeed, that of considerable development of the malar arch, which produces phaenozygy, is present in the Bushmen, as in the skulls of other races exposed to the sun and glare, and other irritants of the eyes; but its working is countervailed by that of thickness of the cranial walls. All the Bushman skulls examined by Dr. Fritsch were broad in the sphenoparietal diameter (see his 'Die Eingeborene Süd-Afrika's,' 1872, p. 413). With two exceptions, those constituted by the skull procured by Mr. Fairclough and that presented by Dr. Bleek, the supraciliary ridges and glabellae are comparatively feebly developed.

The parietal tubera, or the spots on the external surface of the cranium corresponding to them, are placed far back in all these crania, and what I have elsewhere spoken of at some length[1] as the antero-posterior index is consequently high. The same remark, however, may be made of Zulu and other Abantu crania.

It has often been stated that the ears in Bushmen are huge, misshapen, and outstanding. According, however, to trustworthy accounts of Professors Marshall and Flower, and Dr. Murie and Professor Wyman ('Proc. Boston Nat. History Soc.' ix. 1862, p. 56), the small size of the lobule appears to be the only constant character of this organ which is distinctive. (See Fritsch, l. c. p. 410.) Much that has been written on the peculiarity known as 'steatopyga' in our own species might have been spared if what the great naturalist Pallas had written on the similar development called by the same name in one of the most widely spread varieties of the sheep had been studied in the wonderful eleventh Fascicle of

[1] 'British Barrows,' pp. 563 and 677, and Article XV, pp. 168, 277.

his 'Spicilegia Zoologica,' from p. 63 to p. 69. I will quote only a few of the sentences of Pallas's account:—

Page 64.—'In his quidem generalioribus, praesertim deformatione caudae et auribus pendulis greges omnes conveniunt quas Nomades diversarum gentium Asiae possident. Sed varias a temperie caeli, pascuis, aliisque causis vel cultura apud varias hasce gentes mutationes passae sunt et ad Russos translatae patiuntur. In Tatariae Magnae desertis occidentalibus, a Volga usque ad Irtin et Altaicum jugum, pascua maximam partem sunt aridissima, abundant vernalibus plantis acribus et liliaceis; postea aestate in elatis locis quae maxime lanigerum pecus amat praeter siccissima gramina, stipas similiaque, nil nisi artemisias amaras aromaticas, camphorosmam et salsolas succo et salibus abundantes servant. Ubique simul abundant lacunae natroso, culinari, glauberianoque sale efflorescentes, et aquae in desertis iisdem rarae plerumque iisdem salibus foetae sunt. Quae quidem omnia ovium corpulentiae maxime convenire pastores Europaei quoque norunt. Accedit vitae genus et cultura.'

Page 67.—'Sequitur ex istis deforme istud pulvinar sive uropygia quod in locum caudae apud hanc varietatem ovium successit maximeque constantem ejus characterem praebet superfluae generatione pinguedinis ortum debere atque in campis salsuginosis Tatariae occidentalioris primam patriam habuisse. In genere videmus certas corporis partes, illas puto praesertim, in quibus lentior sanguinis circulus obtinet, collectioni pinguedinis in textu celluloso maxime favere.'

Page 68.—'Orta illa semel circa caudam collectio pinguedinis, veluti genialis morbus per generationes sensim adauctus fuit.'

As regards the distinctiveness of steatopyga, or, in other words, as regards the reason which by polygenist writers it was supposed to furnish for considering the Hottentot and Bushman races as specifically distinct from other human beings, there is no need to refer to the analogy which the steatopygous sheep suggests. For as Hartmann ('Die Nigritier,' p. 489, 1876) states, it is found also among Berber and Negro tribes, such as the Maqwa, the Denqa, and the Bonqo; and it may be added that it may be seen figured in the English translation of Schweinfurth's 'Heart of Africa,' by Ellen E. Frewer, vol. ii. p. 121.

As against the ethnological significance of the hypertrophy of the nymphae, which constitutes the 'viel besprochene Hottentotten-Schurze,' the case is still stronger. For not only may this peculiarity be found amongst other African races, such as the Berber, Egyptian, and Negro (according to Hartmann, l. c. p. 489), and the Abantu and Sudan natives (according to Fritsch, 'Die Eingeborene,' pp. 282, 283), where its presence might be reasonably explained by reference to peculiarities of diet or climate, but it may, according to Hartmann, be paralleled by observation carried on in the very different surroundings of North Europe. The words of the last-named authority, whose intimate acquaintance at once

with Africa and Prussia will not be questioned, are to the following effect :—

'Die viel besprochene Hottentotten-Schurze ist für Jemanden welcher fleissig die gebürtshülfliche Station oder den Secirsaal einer grösseren Universität, z. B. Berlin besucht, auch Berber, Aegypter, und Nigritierfrauen ganz nackt gesehen hat, kein auszeichnendes Rassenmerkmal mehr[1].'

The old view which ascribed a Mongolian origin to the Khoi-Khoin races is now pretty generally given up. A more important subject would, if I had space, be furnished me for discussion in the recent discoveries in Central Africa[1], which appear to point to the existence of kinship between the pigmy Akka and Obongo tribes and the Bushman.

The main points which appeared to former writers to indicate Mongolian affinities are the yellow as opposed to the black colour of the skin, the prominence of the cheek-bones, and the supposed obliquity of the opening of the eyelids. This last peculiarity, as Fritsch ('Die Eingeborene Süd-Afrika's, p. 286) has shown, is due simply to the disagreeable necessity of keeping the eyelids constantly half closed, owing to the glare and, as others have pointed out, the sandflies, to which these homeless savages are self-exposed. The Swiss Professor, Schiess-Gemuseus, of Basle, has similarly explained the causation of snow-blindness (see 'Archiv für Ophthalmologie, xxv. 3, p. 173), by reference to the blepharospasmus and conjunctivitis produced by the dryness and the glare of the upland snowfield; and I apprehend that the osseous structures underlying the organs protecting the eye may be reasonably supposed to undergo some modification in correlation with the increased demand for work, which 'blepharospasmus' expresses as being thrown upon the muscular structures which they support. Thus the prominent malar arch and the forwardly projecting outer segments of the orbit, as seen alike in the Mongolian of the treeless steppe, in the Eskimo of the snow-desert, and the Bushman of the sun-burnt South African uplands, may receive a physiological as

[1] Many references to the older literature treating of the two peculiarities mentioned will be found in Waitz's 'Anthropologie,' th. i. pp. 120-122; 1859. An important note regarding the latter of the two is given by a man of science residing at the Cape of Good Hope in Professor Flower and Dr. Murie's 'Account of the Dissection of a Bushwoman,' Journal of Anatomy and Physiology, No. II. May, 1867, p. 208.

[2] For this see Hartmann, 'Die Nigritier,' 1876, p. 492, who cites Schweinfurth, 'Heart of Africa,' Eng. trans. vol. ii. chap. xvi., Du Chaillu, and the Rev. J. G. Wood, 'Natural History of Man,' Africa, p. 538, 1868.

opposed to a morphological explanation. But, when we come further to consider the structure and composition of the various segments of the orbital ring in these races, we find combined with this physiologically explicable similarity a very considerable morphological difference. This is constituted by the conformation of the nasals, which in the Bushman form invariably an all but level plane between the nasal processes of the maxillaries, and contribute, being narrow, but a small factor to the interocular space, which, when the soft parts are *in situ*, appears disproportionately wide as compared with the same area in other races. In Mongols, Eskimos, and Australians the nasals very ordinarily form a more or less elevated arch, and they are not by any means so narrow as they are almost always in the Bushman race. In this latter these bones not rarely lose not only their characteristic arch-shape but also their individuality, and anchylose with each other mesially. It is, however, right to add that nasals of the Bushman type are not rarely, though by no means invariably, to be found in Negro and Caffre crania.

As regards the yellow hue of the skin, the likeness to the Mongolian races proper is perhaps less disputable, but with the skin we are bound to consider the hair, the peculiarities of which, as seen in the Bushman, are as different from those seen in the Mongolian variety of mankind as it is possible for two varieties of human hair from the same area to be. 'The thinnest and flattest hair is that of the Bosjesmans, Papuans, and Negroes; the most cylindrical being that of Polynesians, Malays, Siamese, Japanese and Americans. Europeans are between the two.' Such are the microscopic characters of the hair in the several great divisions of our species according to Topinard ('Anthropology;' translated in 'Library of Contemporary Science' by Dr. Bartley), and it is needless to contrast the spirally contorted and tufted dark hair of the Hottentot or Bushman with the coarse wire-drawn straight black hair of the Mongolian or Eskimo. It is curious, however, if indeed not otherwise significant, that the Central African 'Bushmen,' if so we may call them, of Ashango, occasionally bury their dead in a temporarily diverted stream-course, much as was done in the case of Attila, and, according to Mr. Wood, l. c., 'in various parts of the world from the earliest known time.'

The Bushman race, as is well known, have strong proclivities in

the direction of musical performances. The same however may be said of other priscan races as well as of them and the Mongolian and Kalmuck tribes[1], and we cannot therefore lay any weight upon this point of similarity.

The custom, however explained, which the Khoi-Khoin races have of cutting off one or more joints of the little and ring fingers might, but with no great amount of probability, be taken to point to the existence of an affinity to races as far dislocated in space as the inhabitants of certain islands in Oceania, both Papuan and Malay. The Papuans, according to Sir John Lubbock ('Prehistoric Times,' 1869, p. 445), cut off the end both of the little toe and the little finger as a sign of mourning. The Friendly Islanders (Cook's 'Voyages,' vol. i. 222; Williams's 'Missionary Enterprise,' 547, 548) cut off one or two joints of their little fingers, and the inhabitants of Tracy Island, which was colonised from Samoa, do the like according to the Rev. S. J. Whitwell (Petermann's 'Mittheilungen' for 1871, p. 203). One form of the solemnisation of matrimony amongst the Australians consists in the biting off by a woman of a bit of the little finger of the left hand. I do not know that the fact, deposed to by F. Müller in his contribution to the 'Memoirs on the Voyage of the Novara,' p. 6, to the effect that Caffre women, when a child is sick, or when they themselves become widows, have a piece of their little fingers cut off, need be taken as indicating anything more than the exceeding contagiousness of bad and foolish customs, of which the old anthropologist and zoologist Zimmermann (cit. 'Address to Biological Section of British Association Meeting at Liverpool,' see Report for year 1871) spoke so caustically. Several instances of such adoption and borrowing, on the part of the Abantu tribes, from the conquered and persecuted Khoi-Khoin, might be adduced, and might be paralleled, at some distance, by the fact embodied in the two lines of Horace—

> 'Graecia capta ferum victorem cepit, et artes
> Intulit agresti Latio.'

[1] The point of similarity is not, I apprehend, in the character of the music so much as in the fact that the compared peoples admire it such as it is. Of the Kalmuck music Pallas writes (and, as the work is little accessible, I quote) as follows, 'Sammlungen Historischer Nachrichter über die Mongolischen Völkerschaften,' i. p. 152:— 'Die Melodie der Kalmücken, besonders ihre zartliche und verliebte Musik, hat solche langgezerte klägliche Töne und solche Dissonanzen dass sie ein gutgewohntes Ohr mit noch fast mehr Widerwillen als alte Französische Musik, anhört!'

MEASUREMENTS OF SIX BUSHMAN CRANIA, AS GIVEN BY PROFESSOR FLOWER, F.R.S., IN CATALOGUE OF SPECIMENS ILLUSTRATING OSTEOLOGY AND DENTITION, ROYAL COLLEGE OF SURGEONS OF ENGLAND, 1879, p. 246.

NAME OF SKULL.	C.	L.	B.	BI.	H.	HI.	BN.	BA.	AI.	NH.	NW.	NI.	OW.	OH.	OI.	CA.
1300—O.C. 5357. Adult Male.	500	175	134	766	128	731	91	...	...	46	29	630	38	29	763	1260
1301. Young Female.	486	171	134	784	124	725	91	90	989	44	24	545	37	32	865	1250
1302. Young Female.	477	170	130	765	125	735	90	87	967	44	27	604	38	31	816	1170
1303. Male Bushman, aged.	522	185	140	757	134	724	103	...	...	48	29	604	40	30	750	1400
1304. Young Female.	503	180	137	761	125	694	92	90	978	43	25	581	34	30	882	1360
1305	480 [19·2]	171	132	772	119	696	...	...	...	...	...	...	...	...	...	1075
Averages	494	175	134	767	125	717	93	89	978	45	26	594	37	25	815	1252

Measurements of Six Bushman Crania in Oxford University Museum.

Name of Skull.	C.	L.	B.	BI.	H.	HI.	BN.	BA.	AI.	NH.	NW.	NI.	OW.	OH.	OI.	CA.
788 *d.* Mr. F. Oates, No. 1. Male, ca. 25 aet.	18.8 (475)	6.5 (165)	5.3 (135)	81	4.9 (125)	75	3.6 (93)	3.6 (93)	100	1.6 (41)	1. (25)	62	1.7 (43)	1.3 (33)	76	1142.5
788 *e.* Mr. F. Oates, No. 2. Male, middle life.	19.2 (485)	6.9 (175)	4.9 (124)	70	5.05 (128)	71	3.9 (94)	3.8 (96)	97	1.8 (46)	1.5 (38)	60	1.5 (38)	1.5 (38)	100	1179.8
788 *f.* Mr. F. Oates, No. 3. Probably female. 25–30 aet.	18.6 (475)	6.5 (165)	5. (125)	73	5.1 (130)	78	3.95 (100)	3.9 (99)	100	1.6 (41)	1. (25)	62	1.45 (37)	1.2 (30)	82	1142.5
788 *a.* Dr. Bleek's gift. Aged Male.	18.9 (480)	6.6 (169)	5.2 (131)	77	4.7 (120)	70	3.4 (86)	3.3 (83)	97	1.6 (40)	1.0 (24)	62	1.5 (36)	1.3 (33)	80	1106.0
788 *b.* Mr. Dunsterville's gift. Aged Male.	19.4 (490)	6.8 (173)	5.2 (131)	75	4.2 (113)	65	3.85 (98)	3.6 (91)	93	1.55 (39)	1.1 (28)	70	1.7 (43)	1.25 (32)	73	1179.8
788 *c.* Mr. Fairclough's gift. Male, middle age.	20.3 (515)	7.1 (180)	5.6 (142)	78	5.4 (137)	76	3.5 (89)	3.6 (91)	102	1.9 (48)	1.0 (25)	52	1.5 (38)	1.4 (36)	91	1419.5
Averages	486	171	131	75	125	72	93	92	98	42	27	61	39	33	83	1285

XXVI.

THE BLOOD-CORPUSCLES OF THE ANNELIDES.

Professor Lankester, in a recent number of the 'Quarterly Journal of Microscopical Science[1],' (January 1878, p. 70–73), makes certain statements relating to me, the chief tangible basis for which

[1] Professor Lankester writes as follows:—'The entirely original introduction of Branchiobdella into the list of Annulata with corpusculated 'pseud-haemal fluid' is difficult to explain, since, from what follows, it seems unlikely that Dr. George Rolleston had made himself acquainted, by actual observation, with any of the genera to which he alludes. On page 238 of the second edition of Gegenbaur's 'Grundzüge,' a somewhat awkwardly introduced reference to Dorner's paper on Branchiobdella might lead an unwary reader to suppose that the statements there given, on the authority of Kupffer and Leydig, with reference to the proliferation of blood-corpuscles from the valves of the vessels in other leeches (*Piscicola* and *Clepsine*), have reference to Branchiobdella—which they have not. A glance at Dorner's excellent memoir on Branchiobdella would, however, suffice to satisfy a conscientious bookmaker that the vascular fluid of Branchiobdella has not yet been shown to contain corpuscles, and that it notoriously differs from the vascular fluid of true leeches, in that it most certainly does not 'communicate with the perivisceral cavity so as to form a lacunar circulation.' The introduction of Branchiobdella into the list given by Dr. George Rolleston is, it would seem, due to his having misunderstood the German authors. The statement that 'the pseud-haemal system communicates with the perivisceral cavity so as to form a lacunar circulation in Syllidea, the Opheliae, the Cirratulida, and the Staurocephali' is more difficult to account for than is that relation to Branchiobdella, since, whilst there is here no foundation whatever for such a statement in fact, the description and figures of Claparède with reference to two at least of these genera are admirable in clearness and detail. We are driven to the conclusion that Dr. George Rolleston has acquainted himself with the introduction without having consulted the body of Claparède's work. . . Whilst I regret to find myself unable to accede to the statements in the text-book which I have quoted above, I may point out that the errors therein contained are not traceable to any attempt on the author's part to make original observations in the domain of morphology, but are rather due to a failure to observe accurately the contents of books.' It will be observed that while some of these statements relate to matters of fact, and others to matters of inference based upon facts, or supposed facts, a third set consists mostly of expressions of Professor Lankester's personal opinions. I shall deal only with the two former sets of statements.

is the following quotation from p. cxxix. of my 'Forms of Animal Life,' published in 1870:—

'In a few Annelids, again (*Syllidea armata*, the *Opheliae*, the *Cirratulida*, and the *Staurocephali* and *Branchiobdella*), the so-called pseud-haemal system contains corpusculated blood, and communicates with the perivisceral cavity so as to form a lacunar circulation.'

In answer to Professor Lankester's attack I have to say, that a careful consideration of the passage just quoted, and even *as* just quoted—that is to say, isolated and apart both from the connection in which it stands, and from discussions of the same subject elsewhere in the same book—is sufficient to suggest to any unprejudiced observer that the error which it contains is simply an error of the press. The passage should run, as by a most trifling and obvious transposition and alteration it can be made to run, thus:—

'In a few Annelides, again (*Syllidea armata*, the *Opheliae*, the *Cirratulida*, and the *Staurocephali*), the so-called pseud-haemal system contains corpusculated blood, and *in Branchiobdella* communicates with the perivisceral cavity, so as to form a lacunar circulation.'

As regards the passage when thus altered, I shall hereafter attempt to show that it states what is currently accepted as our knowledge of the subject. But I have first to prove that, as it stands in the book, it should have suggested to Professor Lankester that it should be thus manipulated and altered. Taking then the passage as it stands, and as isolated, I will ask the candid reader to note the eleven words contained in brackets, and particularly the last five of them. He will observe that a comma is placed after each of the three sets of words, '*Syllidea armata*,' 'the *Opheliae*,' 'the *Cirratulida*;' that to these three sets of words, a fourth similar set is added in the words, 'and the *Staurocephali*,' to which no comma is appended; and finally, that to this fourth set of words, denoting a fourth set of Annelides, a fifth set is added in the awkward set of words, 'and *Branchiobdella*.' Surely the clumsy repetition of the particle 'and' might have been considered to indicate that something was wrong in the sentence, and when combined with the fact that no comma is placed after '*Staurocephali*,' must show that this latter word had somehow or other got dissevered from the terminal comma-superseding bracket, by an accidental intercalation into the space left vacant above of the words 'and *Branchiobdella*.' These two words should be slightly altered into '*in Branchiobdella*:' and secondly

slightly transposed, so as to take their place between the next 'and' and the word 'communicates.' Of the adequacy of this argument any conscientious critic can judge without troubling himself to consider the context in which the passage in question stands, or the other two portions of my book in which the subject is treated, and indeed without special knowledge of the matter at all. To proceed synthetically: I will add that anybody who will write the statement out in lines of eight words each or thereabouts, *omitting the words* 'and *Branchiobdella*' from those lines, and will then add them in his MS. with the customary Greek lambda-λ-like note placed interlinearly, will be amused to see how easily the supplemented words come within the grasp of the embracing brackets. Unfortunately, even for my own satisfaction, I allowed my MS. of 'Forms of Animal Life' to be destroyed only quite recently; the printed proofs, happily, I still preserve. Commas and brackets are, it is true, not anatomical or natural history facts, but they are facts of human history, and if looked at carefully, will furnish a scientific observer with as sure a clue to the interpretation of a man's intention as the observation of the actions of one of the lower animals will do as to the interpretation of its meaning on any particular occasion.

Having thus, in the first place, appealed to the judgment of scientific men of every class—that is to say, to the judgment of all fair-judging men who will take the pains to attend to all the circumstances of a very small question—I will, in the second place, adduce some evidence, the appreciation of which does require some special knowledge of the subject, being based upon a consideration of the passage, in connection with its context and its obvious meaning. Anybody who will read that part of my chapter on the sub-kingdom Vermes, from p. cxxii. to cxxxi., which relates to the 'class Annulata proper,' will see that on p. cxxix., the page containing the passage which Professor Lankester has taken for his text, the word 'Annulata' is used no less than four times, and obviously and expressedly as inclusive of the Discophora. The likeness indeed of *Branchiobdella* to the *Naidea* had been hinted at by both Grube in 1851 ('Die Familien der Anneliden,' p. 115), and Claparède in 1868 ('Bibliothèque Univ. de Genève,' N.S. xxii, p. 348); but no one had in 1870 proposed, as Gegenbaur has subsequently (Grundriss, 1878, p. 134), to consider *Branchiobdella* one

of the Oligochaeta rather than one of the *Hirudineae*. I submit, therefore, that I am justified in saying that my readers, on finding the word 'Annelides' used once on a page in which the word 'Annulata' is used several times, might have been expected to suppose that the former word was not used in the same sense as the latter; and the more so as this different and restricted sense is the very sense in which it is used by both Leuckart ('Menschlichen Parasiten,' p. 155, 1863) and Gegenbaur ('Grundzüge,' p. 159, *et alibi*, 1870), the two authors to whose pages I had most constantly referred.

I will now ask the reader to refer to a somewhat wider context, and, turning to a note on p. 138, to observe that there, in opposition to the nomenclature of the two last-cited authorities, and also of De Quatrefages, I argue at some considerable length in favour of connecting the *Hirudineae* with the Annelides. The Introduction to my book was written after the other two parts; and in the corrected proofs now before me, I find that I have, it may be charitably supposed with a view of saving the student from confusion, throughout the part in question altered the word '*Annelides*,' which I had written and had before me in print, to '*Annulata*,' whenever it had been intended to be used in the wide sense in which Lamarck; Milne-Edwards, Grube, and Leydig use it, and I myself, as the note in question proves, should have preferred to use it, and indeed do use it, at pp. 122, 135, 138, so as to include both Discophora and Chaetophora. I do not blame my readers for not having consulted printed proofs which were not accessible to them; persons, however, to whom an inner conviction of their own accuracy may be dear in the face of adverse criticism, may learn from this the advisability of preserving such documentary evidence as that to which I have here referred.

Leaving now the very wearisome and somewhat unprofitable task of self-vindication, I will now proceed to point out that several of Professor Lankester's statements are in opposition, not only to the authorities, but also to the facts of the case.

The first of these statements with which I will deal is to the effect that—

'The vascular fluid of *Branchiobdella* notoriously differs from the vascular fluid of true leeches, in that it most certainly does not *communicate with the perivisceral cavity so as to form a lacunar circulation*.'

The words I have italicised are quoted from my book; but I did not speak of blood, but of blood-vessels, as combining with another blood-carrying cavity. This, however, is mere verbal criticism. What are the facts of the case? *Branchiobdella* is an animal which, so far as I know, never exceeds ½ inch in length, and which, for a satisfactory examination of its internal organs, needs to be rendered transparent by lying some days in acetic acid and subsequently in glycerine. When examined whilst alive under the microscope, Dr. Dorner ('Zeitschrift Wiss. Zoologie,' xv. p. 479, 1865) tells us that the observation of its circulation is made exceptionally difficult by the fact that the dorsal vessel in the posterior part of its length is very closely apposed to the digestive tract, and whilst its walls are in this non-contractile portion of its length extremely thin and transparent, the digestive tract, on the other hand, is dark coloured. In the larger of the two species, *Branchiobdella parasita*, it is true, Dr. Dorner says the intestine has a less dark colouration, and that it is possible in it to make out clearly the course of the dorsal vessel, especially if the animal is kept a long time under the covering glass, and subjected to gentle pressure. The pressure, I will remark, must be very gentle indeed, if it is not to introduce a source of fallacy into such an investigation as this; and this consideration may well make us hesitate before accepting in their entirety, and in the strict sense which the author himself contemplated, the following words of Dr. Dorner (p. 499 l. c.):—

'Das gesammte Blutgefäss-system des Körpers steht so mit im unmittelbaren Zusammenhange, und stellt einen vollständigen Kreislauf dar.'

I may illustrate this matter further by referring to the disputes which were raised in former days as to the existence or non-existence of an orifice of communication between the anterior or exteriorly opening sac of the organ of Bojanus and the secretory part of the organ even in animals of the size of our fresh-water mussels, where the difficulties of being quite sure as to one's ground were by no means so great as in this case. *Branchiobdella*, however, has not, so far as I have been able to find, been as yet met with in the parts of the United Kingdom with which I am acquainted, illustrating therein the well-known natural history law of the partial, and to us often inexplicable, distribution of parasitic organisms, to the life of which, and consequently to the diseases produced by which, other conditions are often necessary besides

that of the presence of their hosts. (See Professor Klebs, 'Vortrag über die Umgestaltung der Medicinischen Anschauungen,' 1878, pp. 52–53, as regards Lepra.) It finds no place in the 'British Museum Catalogue of Worms,' by Dr. George Johnston, 1865, nor in Mr. Edward Parfitt's 'Catalogue of the Annelides of Devon,' published in 1878 ('Trans. Devon Assoc. Science, Literature, and Art'). Mr. W. H. Jackson, Demonstrator of Anatomy in the Oxford University Museum, has often looked for it upon the numerous *Astaci* which are dissected here every term under his guidance, but in vain. I myself, and others elsewhere, have been equally unsuccessful; and though our examinations of the gills have been often rewarded by the sight of the beautiful *Cothurnia Astaci*, I doubt whether it has been the good-fortune of other investigators to meet with this animal, apparently so common on the Continent, within our four seas, or at any rate in these southern counties. Hence I have been obliged to content myself with the plates and descriptions given by Odier and Henle (loc. cit.); by Keferstein ('Archiv Anat. und Phys.' 1863, p. 509); by Dr. Dorner (loc. cit.); and, above all, with the statements of Leuckart and Leydig relating to it, the omission of the two latter of which names from a list of the authorities upon this subject appearing to me to be about as singular a proceeding as would be the omission of the names of Podalirius and Machaon from a list of the doctors in the Iliad. Inaccessible though the animal has been to me in the fresh state, and though the difficulties besetting much of its anatomy are such as to make it more than ordinarily hard to prove a positive, not to say a negative, conclusion respecting it, the animal nevertheless possesses very considerable claims upon the attentive consideration of the classificatory zootomist, being, as it is, an annectent form between the *Hirudineae* and the *Oligochaeta*. And as the peculiarities of its structural arrangements are specially interesting to those who, like myself (see note, p. 138, 'Forms of Animal Life'), would unite the two families together with the *Polychaeta* under the common term 'Annelides,' as a class name[1], a glance at

[1] The question as to the propriety of ranging the Hirudineae or Discophora in the same *class* even with the Chaetophora has been perpetually raised even down to entirely recent times. Grube, in his excellent memoir on 'Die Familien des Anneliden' (Wiegmann's 'Archiv,' 1850, S.A. p. 1), writes thus:—'Ein jeder, der von Anneliden handelt, eine Erklärung schuldig, ob er sie in dem Sinne von Cuvier, von Milne

the plate of figures of this parasite, given in Odier's well-known paper in the 'Mémoires Soc. Hist. Natur. Paris,' i. p. 70, 1822, show that its claims to be allowed to remain in the separate family with the animals of much the same unlovely habits and external form as itself are not lightly to be set aside on the score of their being based simply on teleological adaptations, whilst, on the other hand, the memoirs of Henle (Müller's 'Archiv,' 1835, p. 574) and of Dorner (loc. cit.), dealing as they do with many important points of the internal anatomy only imperfectly handled by the first-named authority, do certainly lend some support to the opposite view of its affinities,—a view which, as already stated, Gegenbaur, in the last edition (1878) of his 'Grundriss der Vergleichenden Anatomie' (p. 134), supports.

My statements as to the existence of corpusculated blood in the vascular system of *Branchiobdella*, and as to the communication of that system with its large perivisceral cavity, were based, and

Edwards, Burmeister, Wiegmann oder R. Leuckart nimmt, und vor allem, ob er die Hirudineen mit ihnen verbinden oder zu den Planarieen (Dendrocoelen, Rhabdocoelen) und Trematoden hinüberführen will.' It is true that Leuckart does ('Menschl. Parasit.' i. p. 156) put the Hirudineae together with the other orders, the Turbellarians, Cestodes, and Trematodes, into a class 'Platodes,' which he keeps separate from a class 'Annelides,' containing the four orders, Acanthocephali, Nematodes, Chaetognathi, and Chaetopodes. He appears to me, however, to have done this rather for purposes of convenience as a helminthologist than as a zoologist; at any rate in the 'Lehrbuch der Zootomie,' published in 1847 by himself and Professor Heinrich Frey, the Hirudineae, s. Abranchiati, are ranged as a sub-order under a sub-class 'Annelides,' and in the 'Menschlichen Parasiten' (p. 673) itself, we find this excellent authority, after specifying the points of similarity which subsist between the leeches and Trematodes as regards their reproductive system, saying:—'Die Aehnlichkeit mit den Trematoden, die wir so eben hervorhoben, erstreckt sich übrigens keineswegs bis auf die Einzelnheiten der anatomischen Bildung. Es finden sich hierin vielmehr so zahlreiche und durchgreifende Unterscheide, dass sich der Typus der Hirudineen auch in dieser Hinsicht als ein selbständiger zu erkennen giebt.' Claus, in the last edition (1876) of his 'Grundzüge der Zoologie,' having in view, I apprehend, not only the utterances of Professor Leuckart, but also the discussions which had taken place between Claparède and De Quatrefages ('Bibliothèque Universelle de Genève,' N.S. vol. xxii. 1865; 'Bull. Sci.' p. 346; and 'Annales des Sciences Naturelles') upon this subject, writes as follows (p. 395):—'Man hat daher neuerdings zumal im Hinblick auf die nahe Verwandtschaft mancher Discophoren und Polystomeen die Anneliden als systematische Einheit ganz aufgegeben und die Auflösung derselben in gegliederte Plattwürmer und gegliederte Rundwürmer befürwortet, allein einerseits erscheint der Anschluss an jene niedere Wurmclasse keineswegs auf die gesammte Organisation durchgreifend, andererseits gerade in dem gemeinsamen Charakter der Segmentirung ein so wesentliches die höhere Lebensstufe bedingendes Merkmal gegeben, dass wir den Verband der Anneliden als wohl gegründet betrachten.'

are still based, mainly, though not exclusively, upon Leuckart's account of these systems in this animal and some of its allies at pp. 651, 652, 665, 670 of the first volume of 'Die Menschlichen Parasiten,' published in 1863. It would take too much space to reproduce these valuable pages here; most of them are referred to in 'Forms of Animal Life' (pp. 138, 140), and Professor Lankester's phrase that the vascular fluid of *Branchiobdella* '*notoriously* differs,' &c., has suggested to me, among other things, that it will be more than sufficient for my purpose to show from references to the utterances of the various writers who have referred to the matter subsequently to the appearance of Leuckart's work, that, as regards 'notoriety,' *Branchiobdella* is 'notoriously' taken as the typical 'text-book' illustration of the points which I specify.

Firstly, then, Professor Oscar Schmidt, well known to English readers as the author of 'The Doctrine of Descent and Darwinism,' in the fifth edition of his 'Handbuch der Vergleichenden Anatomie' (1865)[1], writes as follows with reference to the circulatory system of the *Hirudineae*:—

'The Discophora manifest the most remarkable relations, as it is only in *Branchiobdella* that the perivisceral cavity presents itself as an actual roomy cavity, with which the single large vessel running above the intestinal canal communicates.'

This statement is repeated in the sixth edition (p. 108), word for word, except so far as the substitution of the word 'Egel' for 'Discophoren' makes a difference.

Professor Claus, in the first edition of his 'Grundzüge der Zoologie' (1866), in which (p. viii.) he expressly acknowledges the assistance given to him by Leuckart, has the following passage in a page (p. 155) where Leuckart's researches upon the circulatory system of the *Hirudineae* are specially referred to:—

[1] It will furnish encouragement, perhaps, to lecturers just entering upon their first course of Comparative Anatomy Lectures to read the following passage prefixed to this edition of Professor Oscar Schmidt's 'Handbuch.' Persons who are as little liable to discouragement may, *ceteris paribus*, hope ultimately to attain to an eminence as great as that of the now deservedly well-known Professor. His words are:—'In Sommer Semester 1849 las ich zum ersten Male in Jena über vergleichenden Anatomie. Von den drei Wissbegierigen welche sich gemeldet war der eine schon mit der ersten Stunde befriedigt, und war nicht mehr gesehen. Die beiden anderen bezeigten mir ihre Sympathie bis zum Schluss; nie schwänzten sie zugleich. Das war für dieses Buch sehr wichtig, denn aus den fleissigen Vorbereitungen zu jenem Collegium und unmittelbar aus diesen ersten, oft in ein Zwiegespräch übergehenden Vorträgen entstand es.'

'Am einfachsten verhalt sich *Branchiobdella* mit einem contractilen Rückengefäss und einem in vordern Körperstück durch Schlingen mit dem erstern in Verbindung stehendem Bauchgefässe. Dieses scheint mit der weiten Leibeshöhle zu communiciren und aus derselben das Blut zu beziehen welches durch seine contractile Wandung nach vorn getrieben wird.'

This statement is exactly reproduced at p. 398 of the third edition of Professor Claus's work, which appeared in 1876.

Similarly, Professor Pagenstecher, at p. 373 of his 'Allgemeine Zoologie,' Zweites Theil, 1877, writes:—

'Leuckart meint es möge der Rückenstamm, welcher schon 1719, Dillenius bei den Blutegel beschrieb, mit der bei *Branchiobdella* unter den Hirudineen besonders weiter Leibeshöhle in offener Verbindung stehen, seinen Inhalt aus letzterer beziehen, die in der Leibeshöhle auf und abtreibende Flüssigkeit schon Blut sein.'

As against all these authorities, Professor Lankester himself having made it a question of authorities by his using, *ad augendam invidiam*, the word 'notoriously,' we have to set his statement, unsupported by any record of independent investigation by himself of the structures themselves, to the effect that the vascular system of *Branchiobdella* 'notoriously differs' from that of true leeches, 'in that it *most certainly* does *not* communicate with the perivisceral cavity so as to form a lacunar circulation.'

I have fastened upon Professor Lankester's employment of the word 'notoriously,' and I think that what I have said will 'suffice to satisfy a conscientious bookmaker,' or book-reader, as to the value of the word as thus employed.

The question of fact is very readily stated, and if not very easily settled is yet capable of settlement by persons to whom *Branchiobdellae* are available in the fresh state. It may be put thus: Does the simple unicavitary large perivisceral space of *Branchiobdella*, the homologue of the lymphatic system in general, and of that particular vasiform tritruncate modification of it which is found in so many leeches, differ from the lymphatic system or its homologue in nearly all other animals, if not all, with the exception of the *Chaetophorous Vermes*, by not communicating with the blood-vascular system? I never thought that in the *Hirudineae*, provided, as is 'notoriously' the case in *Hirudo sanguisuga* (Gratiolet, 'Ann. Sci. Nat.' xvii. p. 199, 1862) and in *Piscicola* (see Budge in 'Verhand. Nat. Verein. Preuss-Rheinland,' vi. p. 112, and fig. 24, 1840, and Leuckart, l. c. p. 669), with a system either of smaller or larger tubes, bringing these vasiform specialisations of the perivisceral cavity continuously

into direct communication with the blood-vascular system, there was any likelihood of, as there could be no need for, a lacuna existing to connect the two systems. But where, as in *Branchiobdella*, the perivisceral cavity has not been differentiated even into lateral and median vessels, not to say not into capillaries, and where the blood-vascular system proper itself remains in a condition of comparative simplicity, failing to develop a capillary system upon the walls of the intestine, and having its two great trunks connected by simple arches of anastomosis, the probability that a lacunar should exist, as in so many other cases, in supplementation of the missing capillary intercommunication, appears, as my above-given quotations abundantly show, to be very great.

If *Branchiobdella* is to be considered a leech, it is very strange that it should differ from its allies in not having its perivisceral system freely and openly communicating with its blood-vascular, the acknowledgedly existing difference that its perivisceral system is peritoneiform and not vasiform being a very much smaller difference, as the lacunae of one genus are often enough replaced by vessels in an allied one. If *Branchiobdella* is to be considered one of the Annelides in the restricted sense, as it has, so far as I know, been for the first time proposed in Gegenbaur's 1878 edition of his 'Grundriss der Vergleichenden Anatomie' to consider it, I should still consider the question an open one so far as authority goes, following in this Professor Gegenbaur, who (l. c. p. 179) repeats the words used in the earlier edition of it (p. 198) and in the 'Grundzüge' (ed. 1870, p. 234):—

'Dieser aus einem lacunären system hervorgegangene Gefässapparat ist auf die Hirudineen beschränkt, denn bei den Anneliden ist die Scheidung des Gefäss-systems von der Leibeshöhle fast durchgehend entwickelt. Wo sie fehlt, sind nicht Weiterentwickelungen, wie sie die Differenzirung der Leibeshöhle der Hirudineen bot, sondern Rückbildungen im Spiele.'

Now, I submit that the parasitic habits of *Branchiobdella* are, on general grounds, likely to have produced such a readily-produced 'Rückbildung' as that of leaving a vascular system open at one or more points. And as a third warning against rashly stating that the vascular system of *Branchiobdella* 'most certainly does not communicate' with its perivisceral, I will draw attention to the fact that in *Malacobdella*, which, whether it be nemertine or leech, had anyhow been supposed to possess a closed system of vessels, whether

homologues of lymphatic or of blood-vessels, these vessels have recently been shown by Professor Hoffmann ('Niederland Archiv für Zoologie,' Bd. iv. 1, p. 9, 1877) to possess small round stomata in their walls. It is to be hoped that the question may shortly be set at rest by some anatomist to whom *Branchiobdella* is available in the fresh state, a state in which it is not very easy to transport it to any great distance.

Professor Lankester says:—'A glance at Dorner's excellent memoir on *Branchiobdella* would, however, suffice to satisfy a conscientious bookmaker that the vascular fluid of *Branchiobdella* has not yet been shown to contain corpuscles.' I was not acquainted with Dr. Dorner's memoir till Professor Lankester drew my attention to it in this article; since that I have not merely glanced at it, but studied it carefully. My study, however, of this memoir, combined with that of others treating of the same subject, has not sufficed to satisfy me that the blood of *Branchiobdella* does not contain corpuscles. Indeed the one single passage relating to the interior calibre of the blood-vessels which I have been able to find in this memoir appears to me to *point* at least to the exactly opposite conclusion. This passage runs thus (p. 499):—'Eigenthümlich für das Gefäss-system ist noch eine Anzahl hinter einander liegender Körner, welche der Innenwand anliegen.' For the presence of such granular bodies in such a situation is, to me at least, intelligible only on the hypothesis of their forming blood, and, from the analogy of such Annelides as *Cirratulus*, corpusculated blood for the contents of the vessel which they bestud[1]. Anyhow, Dorner's

[1] Keferstein (Müller's 'Archiv,' 1863, p. 509) speaks of three *stripes* of finely granular pigment as lying upon the inner wall of the dorsal vessel of Branchiobdella, such as many other Annelides, e. g. *Cirratulus filiformis*, previously described by him ('Zeitsch. Wiss. Zool.' 1862, p. 123), possess. Similar stripes are figured by Claparède (pl. xxiii. fig. 3. B, p. 268), 'Les Annélides Chétopodes du Golfe de Naples,' from *Audouinia filigera*, and are stated by him (p. 265) to exist similarly placed either between the muscular coat of the vessels and the tunica intima, or in the substance of this last in *Cirratulus chrysoderma*. Both these animals have corpusculated blood, and it is difficult to think that the suspended granules, which, according to Selenka ('Niederland Arch. für Zoologie,' Bd. ii. 1874–75, p. 34), give the blood of *Aphrodite aculeata* its yellow tinge, do not come from some similar source. 'Blutbereitende organe' of a very different morphology, but from homologous situations, are figured for us by Kupffer as the so-called 'valves' in the dorsal vessel of Piscicola ('Zeitschrift für Wiss. Zool.' xiv. pl. xxix. A, fig. 3, p. 342), and by Leydig, from the homologous locality in the oligochaetous *Phreoryctes menkeanus* ('Archiv für Mikroscop. Anatom.' i. 1865). The proliferation of the large cells, figured by these two

words, which state a positive fact, do not bear out Professor Lankester's suggestion of the negative conclusion proverbially, and here so specially, hard to prove. For, as regards the blood-vascular system of the leeches generally, Leuckart, who includes under them *Branchiobdella*, says (l. c. p. 670):—'The blood of the *Hirudineae* contains exceedingly few blood corpuscles, and these, it should be noted, do not, as it appears, even circulate in every part of the vascular apparatus.' Leuckart then proceeds to describe the various bodies which go by the name of blood-corpuscles in the leeches, with which animals he always classes *Branchiobdella*, and of the vascular system of which animals he takes *Branchiobdella* as a type a few pages back. Similarly Leydig, who repeatedly refers to the histology of *Branchiobdella* (e. g. 'Archiv für Mikros. Anatomie,' i. p. 274, 1865; 'Tafeln zur Vergleich. Anatomie, pl. ii. fig. 6), and must repeatedly have had it, with its faintly-coloured blood, under the microscope, as he tells us ('Zeitsch. Wiss. Zool.' i. p. 117, 1849) he has had *Piscicola*, so like it in this respect, writes of the blood-corpuscles of leeches without ever hinting that *Branchiobdella* (which he, like Leuckart, considers to be one of the *Hirudineae*) differed from them in this same cardinal point of the absence of corpuscles from its vascular fluid. Both, then, of these excellent observers consider *Branchiobdella* to be a leech; both repeatedly treat of its histology; both describe the blood-corpuscles of the *Hirudineae;* neither ever suggests that these corpuscles are wanting to *Branchiobdella*, though one of them, viz. Leydig ('Archiv Mikro. Anat.' l. c. p. 281), does assert this of *Chaetogaster*, an animal, the somewhat

authorities, into numerous small round non-nucleate bodies, which individually are scarcely half the size of the nucleus of the cells, is the source of many, but not of all, the smaller bodies visible in the blood of these animals. Retrograde, however, as well as other changes, count for much of the 'Körnchenbildung' of the blood as usually examined, and good figures of such changes are given by Barry ('Phil. Trans.' 1840, pl. xxix. fig. 6) and by Gulliver (Gerber's 'Anatomy,' fig. 268). The formation of lymph corpuscles by proliferation of the peritoneal endothelium was demonstrated by Schweigger-Seidel and Ludwig, in 1866, in Ludwig's 'Arbeiten' (i. 180). Kölliker ('Gewebelehre,' p. 618, 1867) suggests that the like process may take place in the smaller lymphatic vessels. Remak ('Untersuchungen über Entwickelung,' p. 22) made the same suggestion, in 1855, as to the blood-vessels, and Leydig, in 1857, in his 'Histologie' (p. 447), has the following words:—'Das sog. Gefässepithel scheint ebenfalls durch Zellenwucherung die Zahl der Blutkügelchen vergrössern oder die etwas untergegangenen ersetzen zu können.' (See also 'Bau des Thierischen Körpers,' 1864. p. 67.) Dr. Beale, in his 'Microscope in Medicine' (1878, p. 252), pronounces himself to the same effect.

similar habits, not to say structure, of which would have been likely to suggest a comparison.

One of the most surprising statements in Professor Lankester's paper is to be found on the first page of it (p. 68), and it runs thus :—

'The fact, however, that abundant corpuscles are present in this same fluid [the red vascular fluid of Chaetopodous worms] in the case of the earthworm (and, as appears very probable, in all similar fluids) has hitherto escaped detection, owing to the difficulties of observation which small corpuscles floating in a deeply-coloured liquid present, and also to the fact that the method by which they may be rendered apparent has not been applied to them by the various observers who have occupied themselves with this matter.'

It is difficult indeed to understand, and I shall not make any suggestions as to how Professor Lankester can have come to write this. Professor Wharton Jones, whose writings and views as to the morphology of blood-corpuscles are referred to in every text-book, for example, in the latest edition of Quain and Sharpey and Schäfer, 1876 (p. 42), as 'supported by Busk, Huxley, and Gulliver,' has devoted an entire page (p. 94) of the 'Philosophical Transactions' for 1846, the volume containing the memoir thus currently quoted, to the blood-corpuscles of the earthworm. Amongst many other objects which Professor Wharton Jones records as having been procured by him from the blood of the earthworm, he mentions 'corpuscles altogether like the nucleus and its surrounding granulous mass,' of certain nucleated cells 'both in form and size.' This 'cellaeform nucleus is about $\frac{1}{3600}$th of an inch in diameter, with a finely granulous mass surrounding it.' Professor Lankester describes the corpuscles of the earthworm as follows :—

'They are flattened fusiform bodies, usually somewhat broader at one end than the other, sometimes nearly circular. They vary in size from the $\frac{1}{3500}$th to the $\frac{1}{2000}$th of an inch in long diameter, but by far the majority are of a uniform length of about $\frac{1}{3000}$th of an inch. The corpuscles have a clean, sharp outline, but occasionally what appears to be a small quantity of ragged protoplasm is seen beyond this sharp contour.'

Professor Lankester has not, in this paper, given us any figures of the corpuscles thus clearly described. When his promised figures do appear, it will be interesting to compare them with the descriptions and figures given (l. c.) by Professor Wharton Jones.

Secondly, in the year 1852, Professor Ecker, in the third plate

of his 'Icones Physiologicae' (fig. 21), figures the blood-corpuscles of the earthworm under three denominations, viz. firstly (*a*, *b*, and *c*), 'Körperchen mit vielen Vacuolen und stachlichen Fortsätze, die Form und Stelle wechseln; die Hohlräume mit gelblichem Schimmer,' which amoebiform bodies I believe to be perivisceral in origin; secondly (*d*), 'Kerne,' one variety of which is granular, and the other hyaline as to its contents; and thirdly (*e*), 'Feine Körnchen,' which till lately I held to be the only formed elements existing in the worm's red fluid. But the two kinds of bodies figured by Ecker at (*d*) are to be found in this fluid, when uncontaminated with perivisceral fluid, and before its morphology is upset by the setting in of those changes to which all fluids containing colloids are so liable under the influence of so many disturbing agencies.

Thirdly, in the year 1835 we find Rudolph Wagner (Müller's 'Archiv,' 1835, p. 313) asserting a claim to having seen the blood-corpuscles of the earthworm in 1832, and vindicating himself against an expression of surprise uttered by the elder Carus, in his 'Lehrbuch der Vergleich. Zootomie' (ii. p. 682, 1834) at his not having discovered the 'deutlichen runden abgeplatteten Blutkörperchen im rothen Blute des Regenwurmes.'

Fourthly, Leydig's words ('Histologie,' p. 437, 1857), 'Zu innerst sah man hoch vereinzelte blasse Kerne die wahrscheinlich von Blutkügelchen berührten,' appear to me to apply, even when I take the sentence in its own context alone, to the earthworm; and when I recollect that it was Leydig who pointed out ('Archiv für Mikroskop. Anat.' i. 281, 1865) that *Chaetogaster* has no blood-corpuscles, I cannot but think that he would have made here the same remark as to *Lumbricus* if he had not seen it to be otherwise conditioned, and indeed had not supposed himself to have stated the fact to be so.

Fifthly, I have to say that in the year 1861 the late Dr. John Davy read a paper before the British Association at Manchester on 'The Blood or Red Fluid of the Common Earthworm.' This paper is printed *in extenso* in the second series of 'Physiological Researches' (1863, pp. 203–207). In it Dr. Davy states that I assisted him 'especially in laying bare the cardiac organs, and in procuring their contents.' 'Indeed,' he adds, 'it was at his request that the inquiry was entered upon.' He then gives at

some length an account of the method we employed for collecting the contents of the vascular system, so as to keep them free from admixture with the perivisceral fluid; the essentials of the method being that a delicate pipette with, at one end of it, a very thin bulb, and a sharp perforated point at the other, was used for puncturing the great vessel, and extracting from it 'one or two small drops, varying with the size of the annelid and its condition.' 'The dissections were conducted under water; and before the cardiac organ was opened, which was done out of water, the fluid which bathed the vessel was carefully washed away, and the surface of the vessel was wiped with bibulous paper.' Dr. Davy describes the bodies seen in the red fluid thus obtained as follows:—'Viewed under the microscope with a one-eighth inch power, granules or minute corpuscles were seen scattered through it. These varied a little in size; their average size was about $\frac{1}{14000}$th of an inch, or about one-fourth that of the blood-corpuscles of man. Each corpuscle had a luminous centre and well-defined outlines faintly coloured red or yellowish red. The colouring matter, it was pretty clear, was contained within the cell. After some doubt and many trials, this was the conclusion we arrived at—that the fluid owed its colour, either altogether or in great part, to those corpuscles. I did not at the time entirely agree with Dr. Davy's views, the exceedingly small size of these bodies making me adverse to calling them by the same name as any indubitable 'blood-corpuscles' of invertebrata; whilst two non-quantitative peculiarities observable in many of them compelled me to consider them 'lifeless,' in a more thoroughgoing sense than it has ever been proposed to consider even the mammalian red blood cell. These two peculiarities were, firstly, the presence in many of these spheroids of concentric striation, reminding one of the similar lines in the much larger amyloid bodies from the prostate and the walls of the cerebral ventricles; and secondly, the occupation of the centre of many of them by a rough-hewn, solid, and therefore functionless, dot of yellowish-red pigment. These coloured bodies are strikingly like the pullulations produced in mammalian, and other red blood-corpuscles, by the action of tannin, described by Dr. Roberts. I thought then, and know now, that a large proportion, if not the whole, of these bodies were due to retrograde metamorphosis; and knowing then that the more care (we took too much care) was

taken to exclude the possibility of any intermixture of perivisceral fluid, the smaller was the number of any other elements in a microscopic slide of the red fluid of the worm, I, after some deliberation with myself and others, decided to speak (p. 124) of this fluid as being 'non-corpusculated.' Similarly Dr. A. Rollett, the author of the article 'Blood' in Stricker's 'Handbook,' had said ('Sitzungsb. Akad. Wiss. Wien.' Bd. xliv. 2, 1861, p. 630) of a drop of the worm's red fluid that he never found anything like a red corpuscle in it. The real history of these bodies may be given by saying that they are due to the breaking up of true blood-corpuscles, by a process which brings to an end the interpenetration of their 'zooids' and 'oecoids;' in other words, their genesis is as artificial as that of the similarly minute 'Zimmermannsche Körperchen' in human blood. The way in which I have been led to see this is as follows:—Mr. W. Hatchett Jackson, Demonstrator in the Oxford University Museum, suggested to me that instead of discharging the red fluid from a capillary pipette on to a slide, and so examining it as Dr. Davy and I had done in days before immersion lenses were known in England at least, we should examine it whilst still contained in the pipette and under Hartnack's immersion 10, coagulation occurring very imperfectly, as Professor Schäfer has shown it to do, with frog's blood similarly treated. The red fluid of the worm can thus be seen to possess many true corpuscles, of various sizes, some with homogeneous, some with granular contents, and some with one or more of the solid coloured bodies mentioned above placed either intra- or extra-globularly. The pipette also draws out of the vessels masses of coherent cells, which in their shape and in the variability of their size resemble many of the free cells, but which always have their contents homogeneous. These masses, like the closely similar aggregations figured by Kupffer ('Zeitsch. Wiss. Zool.' xiv. Taf. xxix. fig. 3, *a*, *b*, and *c*), are, no doubt, the product of the proliferation of the blood-vascular endothelium. If the pipette has been cleanly plunged into the vessels, it will not be found to contain any of the large amœbiform or other corpuscles which some authors have ascribed to the blood of the worm. If the red fluid is purposely or accidentally mixed with water, the appearance described by Dr. Davy takes the place of appearances such as Claparède has figured ('Annélides Chétopodes du Golfe de Naples,' pl. xxvi.

fig. 1, G) from the still living blood-vessels of one of the *Opheliae* which in some other respects resembles the *Oligochaeta*.

A more instructive confirmation of the view which regards the minute granules in human blood, known as Zimmermann's bodies, if not those figured by Schultze ('Archiv Mikr. Anat.' pl. i.) as being, in opposition to the views of Zimmermann himself, to whom we owe so much of our right views as to fibrin, mere 'Detritusbildungen,' I cannot conceive than that which is furnished by the watching of the falling to pieces of the lumbricoid corpuscles under the disturbing action of the addition of water, or, though to a less degree, under that of the transference from a glass vessel such as the capillary pipette to the wider contact of glass constituted by the slide and cover [1].

It is possibly even more interesting to remark how closely parallel is the behaviour of alumina, and some other inorganic substances, to that of the sanguigenous colloids which we are dealing with; 'soluble alumina,' says Professor Graham ('Phil. Trans.' 1861, p. 207), 'is one of the most unstable of substances—a circumstance which fully accounts for the difficulty of preparing it in a state of purity. It is coagulated or pectized by portions so minute as to be scarcely appreciable of sulphate of potash, and, I believe, by all other salts, and also by ammonia. A solution

[1] Since writing as above, I came, by following up a reference of Virchow's ('Cell. Path.' ed. 1871, p. 240), upon the following passage (Virchow's 'Archiv,' i. p. 389), in which that observer, in describing the separation of the coloured elements from the rest of the blood-corpuscles, writes as follows:—'Sowohl bei dieser Entwickelungsweise, als da, wo das Hämatin zuerst an Faserstoffgerinnsel, etc., getreten war, sieht man in dem Maasse, als die Körner schärfer hervortreten, am Rande eine farblose Substanz erscheinen, die nicht selten, ähnlich einer Zellenmembran, die Körner umschliesst. Indess habe ich mich nie überzeugen können, dass dieser Saum etwas anderes, als eine homogene Substanz sei; er zeigt keine der Eigenschaften, welche als Kriterien für eine permeable, vom Zelleninhalt trennbare Membran gelten dürfen, und ich muss daher *Gluge* beistimmen, wenn er sagt ('Atlas der Pathol. Anat.' Lief. iii. Melanose, p. 4): "Oft werden die unregelmässigen oder viereckigen schwarzen Massen nur von einer membranösen Unterlage (die wahrscheinlich durch coagulirten Faserstoff gebildet ist) zusammengehalten, und als dann erscheint eine dünne Lamelle unter dem Mikroskop, wie Schildplatt."' Remak, in his 'Entwickelung der Wirbelthiere' (1855, p. 22–23), gave a similar explanation of the nature of the so-called 'Blut-inseln,' speaking of them as 'Zufällige Anhaufungen von Blutzellen welche durch geronnen Faserstoff zusammengehalten und eingehüllt sind.' I incline, however, to think that the concentric striation observable round the pigment nodules above mentioned may be due to the rearrangement of the 'oecoid' after the central concentration of the 'zooid,' which is then surrounded by it much as a rocky islet may be seen at low water to be surrounded by a zone of smooth sand.

containing two or three per cent. of alumina was coagulated by a few drops of well-water, *and could not be transferred from one glass to another, unless the glass was repeatedly washed out by distilled water, without gelatinising*[1].'

[1] The late Professor Max Schultze, in his article in the first number of his 'Archiv für Mikroskopische Anatomie' (1865), whilst observing that 'im Blute ist gewiss kein Bestandtheil gleichgultig' (p. 36), and discussing the import of the 'Zimmermannsche Körperchen,' adds that they have been left unmentioned in the recent handbooks of microscopic anatomy. It may be worth while, therefore, to supply here certain references to memoirs which treat of them, and bodies closely allied to them, and which, with the exception of those by Zimmermann himself, mostly point to their being properly regarded either as *artefacta*, or as morbid, or as *post-mortem* products:—

Zimmermann.—Rust's 'Magazin für Gesammte Heilkunde,' 1846-48, Bd. 66, p. 173.
Virchow's 'Archiv,' xviii. p. 221, 1860.
'Zeitschrift für Wiss. Zoologie,' xi. p. 344.

Virchow.—'Archiv,' i. p. 389, 1847.
'Cellularpathologie,' 1871, pp. 193-266, where these bodies are spoken of as 'Trümmer und Bruchstücke alter Blutkörperchen.'

Schultze (l. c. 1865, pp. 38-41) recommends further investigation into the nature of the several 'Körnchenbildungen' in blood, not considering them to be all alike either *artefacta* or what Mr. Gulliver has called the 'molecular basis of the chyle.'

Böttcher.—Virchow's 'Archiv,' xxxvi. p. 414 seq., 1866.

Hensen.—'Zeitschrift für Wiss. Zool.' xi. p. 259.

Beale.—'Microscope in Medicine,' 1878, pp. 263-4.

Rollett.—Stricker's 'Handbuch,' 1869, p. 300, or p. 413 English translation.

The 'minute spherules' described by Mr. Gulliver ('Gerber's General Anatomy,' pp. 10, 23, 24, 25, Appendix, and fig. 268) appear to be identical with the 'Zimmermannsche Körperchen,' and from his account of them, as also from that given by Martin Barry of the blood, figured by him ('Phil. Trans.' l. c.), we may gather that they are produced in special abundance in altered or altering blood.

XXVII.

ON THE DIFFERENCE OF BEHAVIOUR EXHIBITED BY INULINE AND ORDINARY STARCH WHEN TREATED WITH SALIVARY DIASTASE AND OTHER CONVERTING AGENTS.

The following were the chief results:—

1. Inuline from the Dahlia retains sugar with great tenacity, but by repeated washings it can be freed from that impurity.

2. When thus freed from sugar, it obstinately resists the converting influence of salivary diastase.

3. This salivary diastase was obtained from human saliva, and from parotid and submaxillary gland-substance infused with water and buccal mucus.

4. The same salivary diastase instantly converted ordinary starch into grape-sugar.

5. This salivary-gland infusion, however, if made with salivary gland substance from young animals yet sucking, was found to be ineffectual upon ordinary starch. Bidder's researches were in accordance with this.

These results led to the two following practical rules:—1. Artichokes are little likely to act as a substitute for the potato, as they contain inuline *vice* starch. 2. Starch foods are useless in the early months of infancy, as salivary diastase at such a period is inactive.

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